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NASA/SP—1999–7037/SUPPL407
September 1999

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA

❷ Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes

❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA; Mar. 1996; 130p; In English

Contract(s)/Grant(s): RTOP 505-68-70-04

❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.

❽ Author

❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
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3. Author(s) and Affiliation(s)
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6. Report Number(s); Availability and Price Codes
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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 407)

SEPTEMBER 1999

01
AERONAUTICS

19990064120 George Washington Univ., School of Engineering and Applied Science, Washington, DC USA
Joint Institute for Advancement of Flight Sciences *Final Report, 1 Dec. 1979 - 30 Nov. 1998*
1998; 11p; In English
Contract(s)/Grant(s): NCC1-29; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The program objectives were defined in the original proposal entitled "Program of Research in Flight Dynamics in the JIAFS at NASA Langley Research Center" which was originated March 20, 1975, and in yearly renewals of the research program dated December 1, 1979 to December 1, 1998. The program included three major topics: 1) Improvement of existing methods and development of new methods for flight and wind tunnel data analysis based on system identification methodology. 2) Application of these methods to flight and wind tunnel data obtained from advanced aircraft. 3) Modeling and control of aircraft, space structures and spacecraft. The principal investigator of the program was Dr. Vladislav Klein, Professor at The George Washington University, Washington, D.C.. Thirty-seven Graduate Research Scholar Assistants, two of them doctoral students, also participated in the program. The results of the research conducted during nineteen years of the total co-operative period were published in 23 NASA technical reports, 2 D.Sc. Dissertations, 14 M.S. Theses and 33 papers. The list of these publications is included. The results were also reported in more than 30 seminar lectures presented at various research establishments world-wide. For contributions to the research supported by the co-operative agreement, three NASA Awards were received: 1) NASA LARC Group Achievement Award, May 30, 1990, to Dr. V. Klein as a member of the X-29 Drop Model Team. 2) NASA Medal for Exceptional Engineering Achievement, March 27, 1992, to Dr. V. Klein for innovative contributions in the development of advanced techniques and computer programs in the field of system identification. 3) NASA LaRC Team Excellence Award, May 7, 1994, to Dr. V. Klein as a member of the X-31 Drop Model Team.
Derived from text
Flight Mechanics; Aircraft Control; Aerodynamics; Research; Aircraft Structures; System Identification

19990064412 Physics and Electronics Lab. TNO, The Hague, Netherlands
SALOMO 4.0 User Manual *Final Report*
Keijzers, J. G. M., Physics and Electronics Lab. TNO, Netherlands; vanElst, N. P., Physics and Electronics Lab. TNO, Netherlands; January 1999; 2p; In English; Original contains color illustrations
Contract(s)/Grant(s): A97/KLu/627; TNO Proj. 26869
Report No.(s): TD98-0215; FEL-98-A319; Copyright; Avail: Issuing Activity, Hardcopy

On behalf of the Materiel Directorate of the Royal Netherlands Airforce (RNLAF) the TNO Physics and Electronics Laboratory has developed the Single Airbase LOgistics MOdel (SALOMO). This model, which runs on a personal computer, simulates the processes that are of logistic importance to keep F-16 jet fighters in service at an airbase during peace time. Main purpose of SALOMO is to give the user a better insight into the effect that the processes 'maintenance' (periodical inspections and repairs),'utilisation'(the actual flying), 'preparation' (inspections before and after a flight) and 'spare parts supply' have on both the readiness of F- 16's and the proficiency of pilots. This document is the user manual of the SALOMO 4.0 program. Besides the description of the interaction between SALOMO and the users, it also explains the used input data in relation to the model and the output data. SALOMO 4.0 contains a range of additional functionalities in comparison to SALOMO 3.0
Author
User Manuals (Computer Programs); Logistics; Computerized Simulation; Abilities

19990070316 Logistics Management Inst., McLean, VA USA

The Aviation System Analysis Capability Noise Impact Model *Final Report*

Ege, Russell A., Logistics Management Inst., USA; Brown, Jerome, Logistics Management Inst., USA; Bradley, Kevin, Wyle Labs., Inc., USA; Grandi, Fabio, Wyle Labs., Inc., USA; July 1999; 120p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS2-14361; RTOP 538-16-11-01

Report No.(s): NASA/CR-1999-209356; NS807S1; NAS 1.26:209356; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

To meet its objective of assisting the US aviation industry with the technological challenges of the future, NASA must identify research areas that have the greatest potential for improving the operation of the air transportation system. to accomplish this, NASA is building an Aviation System Analysis Capability (ASAC). The Noise Impact Model (NIM) has been developed as part of the ASAC. Its primary purpose is to enable users to examine the impact that quieter aircraft technologies and/or operation might have on community noise impact and air carrier operating efficiency at any of 16 large and medium size US airports. The analyst chooses an airport and case year for study, selects a runway use configuration and set of flight tracks for the scenario, and has the option of reducing the noise of the aircraft that operate at the airport by 3, 6, and 10 decibels, NIM computes the resultant noise impact and estimates any airline operational improvements. Community noise impact is characterized in three ways: the size of the noise contour footprint, the number of people living within the contours, and the number of homes located in the same contours. Distance and time savings are calculated by comparing the noise abatement flight path length to a less circuitous alternated routing. For a more efficient runway use configuration, the increase in capacity and reduction in delay are shown.

Derived from text

Air Transportation; Systems Analysis; Aircraft Noise; Aircraft Industry

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19990062589 NASA Ames Research Center, Moffett Field, CA USA

Unsteady Transonics of a Wing With Tip Store

Guruswamy, Guru P., Sterling Software, Inc., USA; Goorjian, Peter M., NASA Ames Research Center, USA; Tu, Eugene L., NASA Ames Research Center, USA; Journal of Aircraft; August 1986; Volume 23, No. 8, pp. 662-668; In English; 24th Aerospace Sciences, 6-9 Jan. 1986, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 86-0010; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The presence of tip stores influences both the aerodynamic and aeroelastic performances of wings. Such effects are more pronounced in the transonic regime. In this study, a theoretical method is developed, for the first time, to compute unsteady transonics of oscillating wings with tip stores. The method is based on the small-disturbance aerodynamic equations or motion from the potential-flow theory. to validate the method, subsonic and transonic aerodynamic computations are made for a wing of low aspect ratio, and they are compared with the available experimental data. The comparisons are favorable. The strong effects of the tip store on the transonic aerodynamics on the wing are also illustrated. The method developed in this study can be used for transonic aeroelastic computations of wings with tip stores.

Author

Flexible Wings; Transonic Speed; Wing Tips; Swept Wings; Transonic Flutter; Unsteady Flow; Wing Tanks; Wing Oscillations; Aeroelasticity; External Stores

19990063252 Stanford Univ., Center for Turbulence Research, Stanford, CA USA

Progress in Large-Eddy Simulation of Trailing-Edge Turbulence and Aeroacoustics

Wang, Meng, Stanford Univ., USA; Annual Research Briefs; December 1997, pp. 37-49; In English; See also 19990063249; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this project, we aim to develop numerical prediction methods for trailing- edge aeroacoustics using a combination of LES techniques and aeroacoustic theory based on Lighthill's analogy (Lighthill 1952). With this approach, the instantaneous turbulent flow fields near the trailing-edge are obtained by means of LES. The space-time evolution of the surface pressure fluctuations, useful as forcing function for structural vibration models, is also computed directly. The simulation results allow the acoustic source functions, or the fluctuating Reynolds stress, to be evaluated. The radiated noise can then be computed from an integral-form solution to the Lighthill equation, along the line of Ffowcs Williams & Hall (1970). A second objective of the project

is to study the physical mechanisms for the generation of sound and pseudosound. Besides the edge scattering effect, we are also interested in the roles played by pressure gradients and boundary-layer separation near a trailing edge.
Derived from text
Computational Fluid Dynamics; Large Eddy Simulation; Navier-Stokes Equation; Reynolds Averaging; Reynolds Equation; Reynolds Number; Reynolds Stress; Trailing Edges; Turbulent Flow; Direct Numerical Simulation

19990063262 Stanford Univ., Center for Turbulence Research, Stanford, CA USA
Application of Turbulence Models to High-Lift Airfoils
Kalitzin, Georgi, Stanford Univ., USA; Annual Research Briefs; December 1997, pp. 165-177; In English; See also 19990063249; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This report concentrates on the application of one- to three-equation eddy-viscosity models and, in particular, of the V2F model. The accuracy of the results depends on the turbulence model as well as the underlying numerical flow solver. Some of the difficulties encountered in our computations could be traced back to the artificial viscosity added by the numerical scheme. Particular flow features, such as transition, seem to require a locally very fine mesh or a refinement of the numerical scheme. Second moment closure transport models are often very stiff and too expensive due to the high number of strongly coupled Reynolds stress equations.
Derived from text
Turbulence Models; Airfoils; Turbulent Flow; Turbulent Boundary Layer; Eddy Viscosity; Reynolds Stress

19990063374 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Comparison of Numerical Flow Field Predictions for Army Airdrop Systems *Final Report*
Sahu, Jubaraj; Edge, Harris L.; Heavey, Karen R.; Stein, Keith R.; Benney, Richard J.; May 1999; 31p; In English
Contract(s)/Grant(s): Proj-1L162618AH80
Report No.(s): AD-A364632; ARL-TR-1983; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A computational study has been performed to determine the aerodynamics of Army airdrop systems using computational fluid dynamics (CFD). The validation of flow field predictions from CFD software packages for airdrop systems is difficult because comprehensive experimentally obtained data are lacking. This is especially true for real systems because obtaining desired flow field data during a test is not practical or possible with available technologies. This report examines the results of predictions from two separate CFD codes for the same airdrop systems as an initial step toward validating high performance computing software for modeling airdrop systems. Numerical results have been obtained on two airdrop systems used by the U.S. Army: the T-10 personnel system (no payload) and the G-12 cargo system with and without a payload. The two software packages used for the comparisons are a CFD code that employs a stabilized semi-discrete finite element formulation of the incompressible Navier-Stokes equations and CFD++, a commercially available code. For this numerical experiment, computed unsteady flow fields were obtained with the same unstructured mesh, and predicted flow fields were compared. Similarities and discrepancies in the comparisons are highlighted, and conclusions are drawn from these results.
DTIC
Computational Fluid Dynamics; Air Drop Operations; Finite Element Method; Payloads; Unstructured Grids (Mathematics); Performance Prediction

19990063634 California Univ., Los Angeles, CA USA
Unsteady Aerodynamics - Subsonic Compressible Inviscid Case
Balakrishnan, A. V., California Univ., USA; August 1999; 81p; In English
Contract(s)/Grant(s): NCC2-374
Report No.(s): NASA/CR-1999-206583; H-2337; NAS 1.26:206583; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This paper presents a new analytical treatment of Unsteady Aerodynamics - the linear theory covering the subsonic compressible (inviscid) case - drawing on some recent work in Operator Theory and Functional Analysis. The specific new results are: (a) An existence and uniqueness proof for the Laplace transform version of the Possio integral equation as well as a new closed form solution approximation thereof. (b) A new representation for the time-domain solution of the subsonic compressible aerodynamic equations emphasizing in particular the role of the initial conditions.
Author
Inviscid Flow; Unsteady Aerodynamics; Subsonic Flow; Compressible Flow

19990063789 NASA Langley Research Center, Hampton, VA USA

X-33 Computational Aeroheating Predictions and Comparisons with Experimental Data

Hollis, Brian R., NASA Langley Research Center, USA; Horvath, Thomas J., NASA Langley Research Center, USA; Berry, Scott A., NASA Langley Research Center, USA; Hamilton, H. Harris, II, NASA Langley Research Center, USA; Alter, Stephen J., NASA Langley Research Center, USA; 1999; In English; 33rd; Thermophysics, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 99-3559; Copyright; Avail: Issuing Activity, Hardcopy

The goal of the NASA Reusable Launch Vehicle (RLV) technology program is to develop and demonstrate essential, cost-effective technologies for next-generation launch systems. The X-33 flight vehicle presently being developed by Lockheed-Martin is an experimental Single-Stage-to-Orbit (SSTO) demonstrator that is intended to validate critical technologies for the full-scale RLV. One of the key technologies to be demonstrated on the X-33 vehicle is an advanced, metallic thermal protection system (TPS). As part of the development of this TPS system, the aeroheating environment of the X-33 is being defined through conceptual analysis, ground-based wind-tunnel testing and computational fluid dynamics (CFD). This report provides an overview of the hypersonic aeroheating CFD research conducted at the NASA Langley Research Center (LARC) in support of this TPS development activity. In this research, laminar and turbulent aeroheating predictions were generated at wind-tunnel test conditions for the X-33 vehicle using both a finite-volume, Navier-Stokes solver, and a coupled inviscid-solver/boundary-layer-code engineering method. Computations were performed for angles-of-attack of 20 deg, 30 deg, and 40 degs. Comparisons between the predictions and wind tunnel data for the centerline and axial heating distributions were generally within +/- 10% for the Navier-Stokes method and +/- 25% for the engineering code method. Aeroheating distributions were also computed for the peak heating point on the flight trajectory.

Author

Aerodynamic Heating; Computational Fluid Dynamics; Finite Volume Method; Unstructured Grids (Mathematics); Grid Generation (Mathematics); Navier-Stokes Equation; X-33 Reusable Launch Vehicle; Single Stage to Orbit Vehicles; Design Analysis; Cost Analysis; Cost Effectiveness

19990063792 NASA Langley Research Center, Hampton, VA USA

Computation of Turbulent Wake Flows in Variable Pressure Gradient

Duquesne, N., Royal Inst. of Tech., Sweden; Carlson, J. R., NASA Langley Research Center, USA; Rumsey, C. L., NASA Langley Research Center, USA; Gatski, T. B., NASA Langley Research Center, USA; 1999; In English; 30th; Fluid Dynamics, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-3781; Copyright; Avail: Issuing Activity, Hardcopy

Transport aircraft performance is strongly influenced by the effectiveness of high-lift system. Developing wakes generated by the airfoil elements are subjected to strong pressure gradients and can thicken very rapidly, limiting maximum lift. This paper focuses on the effects of various pressure gradients on developing symmetric wakes and on the ability of a linear eddy viscosity model and a non-linear explicit algebraic stress model to accurately predict their downstream evolution. In order to reduce the uncertainties arising from numerical issues when assessing the performance of turbulence models, three different numerical codes with the same turbulence models are used. Results are compared to available experimental data to assess the accuracy of the computational results.

Author

Turbulent Wakes; Aircraft Wakes; Pressure Gradients; Turbulent Flow; Turbulence Models; Eddy Viscosity; Large Eddy Simulation; Computational Fluid Dynamics; Navier-Stokes Equation; Multiblock Grids; Grid Generation (Mathematics)

19990063794 NASA Langley Research Center, Hampton, VA USA

X-33 Experimental Aeroheating at Mach 6 Using Phosphor Thermography

Horvath, Thomas J., NASA Langley Research Center, USA; Berry, Scott A., NASA Langley Research Center, USA; Hollis, Brian R., NASA Langley Research Center, USA; Liechty, Derek S., NASA Langley Research Center, USA; Hamilton, H. Harris, III, NASA Langley Research Center, USA; Merski, N. Ronald, NASA Langley Research Center, USA; 1999; In English; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 99-3558; Copyright; Avail: Issuing Activity, Hardcopy

The goal of the NASA Reusable Launch Vehicle (RLV) technology program is to mature and demonstrate essential, cost effective technologies for next generation launch systems. The X-33 flight vehicle presently being developed by Lockheed Martin is an experimental Single Stage to Orbit (SSTO) demonstrator that seeks to validate critical technologies and insure applicability to a full scale RLV. As with the design of any hypersonic vehicle, the aeroheating environment is an important issue and one of the key technologies being demonstrated on X-33 is an advance metallic Thermal Protection System (TPS). As part of the

development of this TPS system, the X-33 aeroheating environment is being defined through conceptual analysis, ground based testing, and computational fluid dynamics. This report provides an overview of the hypersonic aeroheating wind tunnel program conducted at the NASA Langley Research Center in support of the ground based testing activities. Global surface heat transfer images, surface streamline patterns, and shock shapes were measured on 0.013 scale (10-in.) ceramic models of the proposed X-33 configuration in Mach 6 air. The test parametrics include angles of attack from -5 to 40 degs, unit Reynolds numbers from 1 x 10(exp 6) to 8 x 10(exp 6)/ft, and body flap deflections of 0, 10, and 20 deg. Experimental and computational results indicate the presence of shock/shock interactions that produced localized heating on the deflected flaps and boundary layer transition on the canted fins. Comparisons of the experimental data to laminar and turbulent predictions were performed. Laminar windward heating data from the wind tunnel was extrapolated to flight surface temperatures and generally compared to within 50 deg F of flight prediction along the centerline. When coupled with the phosphor technique, this rapid extrapolation method would serve as an invaluable TPS design tool.

Author

Aerodynamic Heating; Computational Fluid Dynamics; Hypersonic Speed; Hypersonic Vehicles; X-33 Reusable Launch Vehicle; Single Stage to Orbit Vehicles; Design Analysis; Spacecraft Design; Advanced Launch System (STS); NASA Space Programs

19990063799 Tamkang Univ., Dept. of Water Resources and Environmental Engineering, Taipei, Taiwan, Province of China

Aerodynamic Forces on Two Stationary and Oscillating Square Prisms in Tandem and Side by Side Arrangements

Lu, Po–Chien, Tamkang Univ., Taiwan, Province of China; Cheng, Chii–Ming, Tamkang Univ., Taiwan, Province of China; Cheng, Chieh–Wen, Tamkang Univ., Taiwan, Province of China; Journal of The Chinese Institute of Engineers; September 1998; ISSN 0253-3839; Volume 21, No. 5, pp. 535-546; In English

Contract(s)/Grant(s): NSC-86-2621-E-007; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to gain further understanding of aerodynamic forces and their effects on groups of high-rise buildings, this study used wind-tunnel experiments. Two square prisms were arranged both in tandem and side-by-side arrangement with different spacings in between. Similar experiments were carried out to study the interactions of aerodynamics between the two prisms when both were stationary, when only one prism oscillated, and finally, when both prisms oscillated. The results showed that the aerodynamic responses were either enhanced or suppressed by the spacing ratios, the oscillating frequencies, and the mutual influences of the two square prisms in various arrangements. The aerodynamics also changed due to the occurrences of different flow patterns, such as channel flow, deflected flow, pulsating flow, and so on. Obviously, the aerodynamics of the flow patterns of the two square prisms in tandem and side-by-side arrangements proved to be more complex than those of a single square prism.

Author

Aerodynamic Forces; Wind Tunnel Tests; Buildings; Prisms; Flow Distribution

19990063958 Minnesota Univ., Dept. of Aerospace Engineering and Mechanics, Minneapolis, MN USA

Finite Element Computation of the Dynamics of Large Ram Air Parachutes *Final Report, Sep. 1993 - 1998*

Garrard, William L.; Tezduyar, Tayfun; Jan. 08, 1999; 7p; In English

Contract(s)/Grant(s): DAAH04-93-G-0514

Report No.(s): AD-A364233; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research is aimed at simulation of the aerodynamics/dynamics of large parafoils. Parallel computation methods for 3D simulation of the dynamics and fluid dynamics of a parafoil, with prescribed, time-dependent shape changes were studied. The mathematical model was based on the time-dependent, 3D Navier-Stokes equations governing the incompressible flow around the parafoil, and Newton's law of motion governing the dynamics of the parafoil,, with the aerodynamic forces acting on the parafoil, calculated from the flow field. The computational methods developed for these 3D simulations include a stabilized space-time finite element formulation to accommodate for the shape changes, special mesh generation and mesh moving strategies developed for this purpose, iterative solution techniques for the large, coupled nonlinear equation systems involved, and parallel implementation of all these methods on scalable computing systems.

DTIC

Mathematical Models; Computerized Simulation; Inflatable Structures; Gliding; Finite Element Method; Parachutes

19990064106 NASA Glenn Research Center, Cleveland, OH USA

Numerical Speed of Sound and its Application to Schemes for all Speeds

Liou, Meng–Sing, NASA Glenn Research Center, USA; Edwards, Jack R., North Carolina State Univ., USA; June 1999; 13p; In English, 14th; Computational Fluid Dynamics, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics

Contract(s)/Grant(s): RTOP 523-26-13

Report No.(s): NASA/TM-1999-209286; NAS 1.15:209286; E-11755; AIAA Paper 99-3268; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The concept of "numerical speed of sound" is proposed in the construction of numerical flux. It is shown that this variable is responsible for the accurate resolution of discontinuities, such as contacts and shocks. Moreover, this concept can be readily extended to deal with low speed and multiphase flows. As a results, the numerical dissipation for low speed flows is scaled with the local fluid speed, rather than the sound speed. Hence, the accuracy is enhanced the correct solution recovered, and the convergence rate improved. We also emphasize the role of mass flux and analyze the behavior of this flux. Study of mass flux is important because the numerical diffusivity introduced in it can be identified. In addition, it is the term common to all conservation equations. We show calculated results for a wide variety of flows to validate the effectiveness of using the numerical speed of sound concept in constructing the numerical flux. We especially aim at achieving these two goals: (1) improving accuracy and (2) gaining convergence rates for all speed ranges. We find that while the performance at high speed range is maintained, the flux now has the capability of performing well even with the low speed flows. Thanks to the new numerical speed of sound, the convergence is even enhanced for the flows outside of the low speed range. to realize the usefulness of the proposed method in engineering problems, we have also performed calculations for complex 3D turbulent flows and the results are in excellent agreement with data.

Author

Acoustic Velocity; High Speed; Low Speed; Multiphase Flow; Turbulent Flow; Inviscid Flow; Ideal Gas

19990064146 North Carolina State Univ., Raleigh, NC USA

Improved Models for the Porous Surface with Passive Control *Final Report*

Kraushaar, Sandra L., North Carolina State Univ., USA; Chokani, Ndaona, North Carolina State Univ., USA; [1996]; 58p; In English

Contract(s)/Grant(s): NAG1-1819; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A computational investigation of afterbody flow using a passive control method is conducted. The passive control method consists of a porous surface placed over a plenum. The purpose of the passive control method is to exploit the adverse pressure gradient present in afterbody flow in an attempt to reduce boundary layer separation and afterbody drag. Four different porous wall models are used to model the transpiration velocity in the region of passive control. A three-dimensional, time-dependent, Reynolds-averaged, simplified Navier-Stokes solver, PAB3D, is used to simulate afterbody flow with and without passive control. Three afterbody configurations with boat-tail angles of 10, 20, and 30 deg. are used to obtain two-dimensional solutions with a freestream Mach number of 0.6 and nozzle pressure ratio of 6. The region of passive control was initially placed from 20-60% of the nozzle length. The effect of the porous placement and porous extent is also studied. Baseline (no porosity) two-dimensional solutions are qualitatively similar to experimental data but under-predict the magnitude of the pressure recovery. Results for the subsonic solutions show losses in the pressure recovery for some cases with passive control. Three-dimensional effects are also investigated and seen to be very significant. Three-dimensional baseline solutions, for both sub- and super-critical freestream Mach numbers, compare very favorably with the experimental data in comparison to the two-dimensional solution. Future work is required to examine three-dimensional afterbody flows with passive porosity.

Author

Porous Boundary Layer Control; Afterbodies; Boundary Layer Separation; Subsonic Speed; Navier-Stokes Equation; Three Dimensional Flow; Aerodynamic Drag; Porous Walls; Pressure Recovery; Aircraft Control; Wind Tunnel Tests

19990064413 NASA Langley Research Center, Hampton, VA USA

X-33 Aerodynamic and Aeroheating Computations for Wind Tunnel and Flight Conditions

Hollis, Brian R., NASA Langley Research Center, USA; Thompson, Richard A., NASA Langley Research Center, USA; Murphy, Kelly J., NASA Langley Research Center, USA; Nowak, Robert J., NASA Langley Research Center, USA; Riley, Christopher J., NASA Langley Research Center, USA; Wood, William A., NASA Langley Research Center, USA; Alter, Stephen J., NASA Langley Research Center, USA; Prabhu, Ramadas K., Lockheed Martin Engineering and Sciences Co., USA; 1999; 18p; In English; Atmospheric Flight Mechanics, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 99-4163; Copyright; Avail: Issuing Activity, Hardcopy

This report provides an overview of hypersonic Computational Fluid Dynamics research conducted at the NASA Langley Research Center to support the Phase II development of the X-33 vehicle. The X-33, which is being developed by Lockheed-Martin in partnership with NASA, is an experimental Single-Stage-to-Orbit demonstrator that Is intended to validate critical technologies for a full-scale Reusable Launch Vehicle. As part of the development of the X-33, CFD codes have been used to predict the aerodynamic and aeroheating characteristics of the vehicle. Laminar and turbulent predictions were generated for

the X-33 vehicle using two finite- volume, Navier-Stokes solvers. Inviscid solutions were also generated with an Euler code. Computations were performed for Mach numbers of 4.0 to 10.0 at angles-of-attack from 10 deg to 48 deg with body flap deflections of 0, 10 and 20 deg. Comparisons between predictions and wind tunnel aerodynamic and aeroheating data are presented in this paper. Aeroheating and aerodynamic predictions for flight conditions are also presented.
Author
X-33 Reusable Launch Vehicle; Computational Fluid Dynamics; Hypersonics; Research; Wind Tunnel Tests; Flight Conditions

19990064492 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA
Numerical Simulations of Unsteady Low-Reynolds-Number Flows Over the APEX Airfoil
Tatineni, Mahidhar, California Univ., USA; Zhong, Xiao-Lin, California Univ., USA; 1998; 12p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC2-374; NASA Order H-2352
Report No.(s): AIAA Paper 98-0412; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Laminar and transitional separation bubbles are an important feature of low-Reynolds-number flows over airfoils. The separation bubbles are unsteady and have a significant impact on the aerodynamic properties of the airfoils. In this paper unsteady low-Reynolds-number separated flows over the APEX airfoil are calculated using a Navier-Stokes solver. The numerical results show the presence of unsteady separation bubbles in the flowfield. An analysis of the numerical results shows that flowfield disturbances are amplified significantly in the separation bubble, leading to periodic vortex shedding. A linear stability analysis of the separated boundary layer is performed and the results show that the dominant wavenumber and frequency in the numerical simulations agree with the most unstable wavenumber and frequency from the linear stability analysis. The numerical results also show the growth and interaction of disturbance waves in the separation bubble. For transonic flows over the APEX airfoil, the calculations show that the presence of shocks causes significant changes in the separation location and consequently, the overall flowfield.
Author
Unsteady Flow; Low Reynolds Number; Airfoils; Computational Fluid Dynamics; Navier-Stokes Equation; Subsonic Flow; Transonic Flow; Separated Flow; Flow Distribution; Two Dimensional Flow; Boundary Layer Separation

19990064493 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA
Spurious Numerical Oscillations in Numerical Simulation of Supersonic Flows Using Shock Capturing Schemes
Lee, Theodore K., California Univ., USA; Zhong, Xiao-Lin, California Univ., USA; 1998; 16p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC2-374; NASA Order H-2353; F49620-97-1-0030
Report No.(s): AIAA Paper 98-0115; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The numerical simulation of transitional and turbulent processes in hypersonic boundary layers often involves a physical process of a shock-disturbance wave interaction in complex two-dimensional and three-dimensional flow fields. For such simulations, it is required that there be a high order of accuracy in capturing both the shock and the small disturbances. The purpose of this paper is to evaluate the viability of using high order shock capturing schemes to track small disturbances in a multi-dimensional steady hypersonic flow. The numerical methods that are to be studied are the Total Variation Diminishing (TVD) scheme, and Essentially Non-Oscillatory (ENO) scheme. This paper shows that the presence of numerical oscillations in the flow field solution may drastically hinder any attempt at tracking the propagation of any physical disturbances. It has been found that the numerical oscillations that exist for shock capturing methods may be significant enough to pollute a flow field containing small physical disturbances. The effects of the refinement of the grid do not reduce the oscillations, but rather they decrease the wavelength of the oscillations. It is shown that by aligning the shock with the grid, the amplitude of these spurious oscillations may be greatly reduced.
Author
Essentially Non-Oscillatory Schemes; Oscillations; Supersonic Flow; TVD Schemes; Shock Wave Interaction; Computational Fluid Dynamics; Euler Equations of Motion; Two Dimensional Flow; Steady Flow; Hypersonic Flow

19990064495 University of South Alabama, Mechanical Engineering Dept., Mobile, AL USA
Shear-Layer Effects on Trailing Vortices
Zheng, Z. C., University of South Alabama; [illegible]zaek, K., University of South Alabama, USA; 1998; 10p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NAG1-1911
Report No.(s): AIAA Paper 98-0316; Copyright; Avail: Issuing Activity, Hardcopy

Crosswind shear can influence the trailing vortex trajectories significantly, according to both field measurement and numerical simulations. Point vortex models are used in this paper to study the fluid dynamic mechanism in the interactions between trailing vortex pair and shear layers. It has been shown that the shear-layer deformation causes the vortex descent history difference in the two vortices of the vortex pair. When a shear layer is below the vortex pair with the same sign as the left vortex, the right vortex descends less than the left vortex. When the same shear layer is above the vortex pair, the right vortex descends more. The descent altitudes of the two vortices are the same when they go through a constant, non-deformed shear layer. Those trends are in agreement with Navier-Stokes simulations.
Author
Shear Layers; Vortices; Trailing Edge Flaps; Wind Direction

19990064563 NASA Langley Research Center, Hampton, VA USA
X-33 Hypersonic Aerodynamic Characteristics
Murphy, Kelly J., NASA Langley Research Center, USA; Nowak, Robert J., NASA Langley Research Center, USA; Thompson, Richard A., NASA Langley Research Center, USA; Hollis, Brian R., NASA Langley Research Center, USA; Prabhu, Ramadas K., Lockheed Martin Engineering and Sciences Co., USA; 1999; 16p; In English; Atmospheric Flight Mechanics, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-4162; Copyright; Avail: Issuing Activity, Hardcopy

Lockheed Martin Skunk Works, under a cooperative agreement with NASA, will build and fly the X-33, a half-scale prototype of a rocket-based, single-stage-to-orbit (SSTO), reusable launch vehicle (RLV). A 0.007-scale model of the X-33 604B0002G configuration was tested in four hypersonic facilities at the NASA Langley Research Center to examine vehicle stability and control characteristics and to populate an aerodynamic flight database in the hypersonic regime. The vehicle was found to be longitudinally controllable with less than half of the total body flap deflection capability across the angle of attack range at both Mach 6 and Mach 10. At these Mach numbers, the vehicle also was shown to be longitudinally stable or neutrally stable for typical (greater than 20 degrees) hypersonic flight attitudes. This configuration was directionally unstable and the use of reaction control jets (RCS) will be necessary to control the vehicle at high angles of attack in the hypersonic flight regime. Mach number and real gas effects on longitudinal aerodynamics were shown to be small relative to X-33 control authority.
Author
X-33 Reusable Launch Vehicle; Hypersonic Vehicles; Hypersonic Flight; Hypersonic Speed; Wind Tunnel Tests; Aerodynamic Stability; Dynamic Stability; Flight Control

19990066626 NASA Ames Research Center, Moffett Field, CA USA
Chemical and Thermal Nonequilibrium Heat-Transfer Analysis for Hypervelocity, Low Reynolds Number Flow
Brown, Kevin G., NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermophysical Aspects of Re-Entry Flows; 1986; Volume 103, pp. 445-475; In English; 20th; Thermophysics, 19-21 Jun. 1985, Williamsburg, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 85-1033; ISBN 0-930403-10-X; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Chemical and thermal nonequilibrium phenomena are studied in the stagnation region of a hypervelocity blunt body. This investigation is motivated by the need to predict the heat-transfer rate to the leading edge of aeromaneuvering orbital transfer vehicles. Flight speeds of approximately 10 km/s at altitudes of approximately 80 km are considered for body radii of 1-50 cm. The analysis is based on continuum theory and is applicable to the viscous and incipient merged layer regimes of rarefied flow. A two-species, two-temperature gas model is assumed. Comparisons are made with previous theories, experimental data, and results based on the thermodynamic equilibrium assumption. The equation accounting for vibrational nonequilibrium is presented and its effects on flow properties are discussed. Parameters requiring further investigation are identified. Preliminary results indicate that the inclusion of vibrational relaxation has little effect on the heat-transfer rate for a fully catalytic surface. However, vibrational nonequilibrium may increase the heat-transfer rate to a noncatalytic surface, depending on the degree of nonequilibrium.
Author
Thermal Analysis; Heat Transfer; Nonequilibrium Conditions; Hypervelocity Flow; Research; Blunt Bodies; Thermodynamic Equilibrium

19990066688 Aerotech Engineering and Research, Lawrence, KS USA
Prediction of Antisymmetric Buffet Loads on Horizontal Stabilizers in Massively Separated Flows *Final Report*
Farokhi, Saeed, Aerotech Engineering and Research, USA; Mirsafian, Saeid, Aerotech Engineering and Research, USA; Sherwood, Tom, Aerotech Engineering and Research, USA; Ewing, Mark, Aerotech Engineering and Research, USA; May 1999; 146p; In English

Contract(s)/Grant(s): DTRS57-95-C-00091

Report No.(s): AD-A365010; DOT/FAA/AR-99/27; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

The Federal Aviation Administration (FAA) has a continuing program to collect data and develop predictive methods for aircraft flight loads. Some of the most severe and potentially catastrophic flight loads are produced by separated flows. Structural response to the aerodynamic excitation produced by separated flows is defined as buffeting. A low-cost technique for the prediction of full-scale buffet loads on horizontal stabilizers of aircraft is described. A 1/13-scale rigid generic wind tunnel model with a t-tail configuration (based on the Beech Super King Air 200) was constructed and tested at the Wichita State University 7x10 ft. subsonic wind tunnel. The test matrix included a dynamic pressure range of 25 to 45 psf; an angle-of-attack range of -5 to 20 degrees, and a sideslip range of 0 to 20 degrees. The stabilizer was instrumented with differential pressure transducers and strain gages. The measured pressure power spectra and cross-spectral densities were scaled and used to excite a full-scale aeroelastic finite element model which included the tail structure and aft tail cone. The computed horizontal stabilizer rolling moment power spectra are used to determine the number of exceedences (within a known probability) of a specified rolling moment level per a given maneuver (e.g., stall). Representative pressure, strain gage, and rolling moment power spectra are discussed as is a selected exceedence estimate.

DTIC

Separated Flow; Wind Tunnel Tests; Boundary Layer Separation; Finite Element Method; Stabilizers (Fluid Dynamics); Scale Models; Aerodynamic Loads; Aeroelasticity; Buffeting

19990067211 NASA Ames Research Center, Moffett Field, CA USA

Problems of Rate Chemistry in the Flight Regimes of Aeroassisted Orbital Transfer Vehicles

Park, Chul, NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 511-537; In English; 19th; Thermophysics, 25-28 Jun. 1984, Snowmass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 84-1730; Copyright; Avail: Issuing Activity, Hardcopy

The dissociating and ionizing nonequilibrium flows behind a normal shock wave are calculated for the density and vehicle regimes appropriate for aeroassisted orbital transfer vehicles; the departure of vibrational and electron temperatures from the gas temperature as well as viscous transport phenomena are accounted for. From the thermodynamic properties so determined, radiative power emission is calculated using an existing code. The resulting radiation characteristics are compared with the available experimental data. Chemical parameters are varied to investigate their effect on the radiation characteristics. It is concluded that the current knowledge of rate chemistry leads to a factor-of-4 uncertainty in nonequilibrium radiation intensities. The chemical parameters that must be studied to improve the accuracy are identified.

Author

Orbit Transfer Vehicles; Aeroassist; Vibration; Normal Shock Waves

19990069620 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Defense Acquisitions: Progress of the F/A-18E/F Engineering and Manufacturing Development Program

Jun. 15, 1999; 28p; In English

Report No.(s): AD-A364757; GAO/NSIAD-99-127; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The F/A-18E/F program began, in 1992 to increase the operational capabilities of the current fleet of F/A-18 aircraft. The objectives of the program are to provide improved capabilities over current F/A-18s in the following key areas-range; payload, carrier recovery payload, growth capacity, and survivability. Congress capped the development effort at $4.88 billion (in fiscal year 1990 dollars) and directed that the E/F unit procurement cost not exceed 125 percent of current C/D model costs. The F/A-18E/F development flight test program began in February 1996. The Integrated Test Team, using five single-seat E models and two 2-seat F models, is conducting the tests. Two early operational assessments of the E/F aircraft, using wind tunnel data and analytical models, were made in early 1996 and 1997. Two operational assessments of the E/F aircraft, based on data obtained during test flights using the engineering and manufacturing development aircraft, were conducted in November 1997 (OT-IIA) and in June through August 1998 (OT-IIB). The Navy's Operational Test and Evaluation Force (OPTEVFOR) conducted these assessments.

DTIC

Flight Tests; F-18 Aircraft; Design to Cost; Aircraft Design

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19990063371 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information, May 1999, Volume 27, Number 5
May 1999; 12p; In English
Report No.(s): AD-A364618; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This periodical deals with all aspects of army aviation. Topics dealt with are Bosnia Success Story: Managing risk in Real-World Operations, Power Available vs. Power Required, UH-60 dual engine rollback and Accidents Brief.

DTIC

Aircraft Safety; Management Information Systems; Information Management

19990063372 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information, April 1999, Volume 27, Number 4
Apr. 1999; 12p; In English
Report No.(s): AD-A364621; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This periodical deals with all aspects of army aviation. Topics dealt with are Call of the Wild: Preventing Bird Strikes on Army Airfields, At Davison AAF, thermal is for the Birds, The A.T. Flyaway Blues, Along for the Ride and Accident Briefs.

DTIC

Aircraft Safety; Bird-Aircraft Collisions; Information Management; Management Information Systems

19990063373 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information, July 1999, Volume 27, Number 7
Jul. 1999; 12p; In English
Report No.(s): AD-A364625; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This periodical deals with all aspects of army aviation. Some of the articles are Welcome to Hell, When things don't Seem Right, Leadership vs Management: Some Food for Thought, and Accident Briefs.

DTIC

Aircraft Safety; Information Management; Management Information Systems

19990063378 Army War Coll., Carlisle Barracks, PA USA
A Phoenix Event: Responding With Unity of Effort
DeKinder, Dale L.; Apr. 07, 1999; 43p; In English
Report No.(s): AD-A364488; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A National Security Strategy for a New Century (NSS) repeatedly describes an ever growing terrorist threat, emphasizing the need to protect U.S. vital infrastructure from such threats. Such actions, not if but when they happen, have strategic national and military importance. Terrorist actions are addressed under the rubric of Military Operations Other Than War (MOOTW). MOOTW doctrine specifies guiding principles for combating these actions. One principle in particular, Unity of Effort, is historically elusive. Further, the NSS lists transportation as part of our vital infrastructure. This study examines MOOTW principles, primarily Unity of Effort, as they apply to countering a terrorist strike targeting a vital component of U.S. national infrastructure: air transportation.

DTIC

Aircraft Safety; Air Transportation; Military Operations; Security

19990063669 Naval Postgraduate School, Monterey, CA USA
Optimizing Strategic Airlift
Baker, Steven F., Naval Postgraduate School, USA; Morton, David P., Naval Postgraduate School, USA; Rosenthal, Richard E., Naval Postgraduate School, USA; Williams, Laura Melody, Naval Postgraduate School, USA; Apr. 1999; 41p; In English
Report No.(s): AD-A364609; NPS-OR-99-004; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

We describe a large scale linear programming model for optimizing strategic airlift capability. The model routes cargo and passengers through a specified transportation network with a given fleet of aircraft subject to many physical and policy constraints. The time dynamic model captures a significant number of the important aspects of an airlift system in a large scale military

deployment, including aerial refueling, in theater aircraft shuttles, and constraints based on crew availability. Several applications of the model are given.
DTIC
Computerized Simulation; Linear Programming; Mathematical Models; Dynamic Models; Lift

19990063674 National Transportation Safety Board, Washington, DC USA
Safety Recommendation
Oct. 07, 1998; 177p; In English
Report No.(s): AD-A364222; No Copyright; Avail: CASI; A02, Microfiche; A09, Hardcopy

On February 8, 1997, about 1935 Atlantic standard time, a Cessna 402, N318AB, operating under the provisions of Title 14 Code of Federal Regulations (CFR) Part 135 as Air Sunshine flight 319, crashed into the Caribbean Sea southwest of St. Thomas, US Virgin Islands. The flight had been a regularly scheduled flight operating under visual flight rules (VFR) between St Thomas and St. Croix. The airplane was destroyed; two passengers were killed, and the pilot and two of the remaining four passengers sustained minor injuries. Night, visual meteorological conditions prevailed at the time. The pilot, who had accrued over 11,000 hours in the 400-series Cessna airplane types, mostly in the south Florida area, had begun flying in the Caribbean area less than a week before the accident. The pilot estimated that he had executed between 10 and 15 approaches to St. Thomas, with 4 or 5 of those at night. The pilot told Safety Board investigators that, at the time of the accident, he was unable to receive the distance measuring equipment' signal from St. Thomas. Consequently, he was especially attentive to receiving and establishing the proper localized course to St. Thomas to remain clear of the mountains on the north side of the island. The pilot said that he encountered some difficulties receiving the radio signal and was attempting to adjust the localized course setting. During this time, the pilot noticed that the airplane was passing through 1,100 feet mean sea level. The pilot said that he refocused on the localized and then the airplane struck the water about 3 miles from shore.
DTIC
Safety Management; Accident Prevention

19990063680 Defence Science and Technology Organisation, Melbourne, Australia
A Rapid Mapping and Analysis System for Use During Aircraft Accident or Incident Field Investigation
Barter, S.; Mar. 1999; 48p; In English
Report No.(s): AD-A364162; DSTO-TR-0780; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

AMRL has developed a system to aid in the rapid mapping and the management of information gathered at aircraft accident and incident sites. This system is based on commercial mapping instrumentation which uses differentially corrected Global Positioning System (GPS) data, a medium resolution digital camera and a geographical information system (GIS) software package. This paper introduces GPS, GIS and digital imaging, their use in the mapping and analysis of aircraft accidents, and a description of the AMRL equipment.
DTIC
Aircraft Accident Investigation; Aircraft Accidents; Information Systems

19990063821 NASA Ames Research Center, Moffett Field, CA USA
Safety Analysis of FMS/CTAS Interactions During Aircraft Arrivals *Final Report*
Leveson, Nancy G., NASA Ames Research Center, USA; Final Report: Safety Analysis of FMS/CTAS Interactions During Aircraft Arrivals; Dec. 27, 1998; 33p; In English; See also 19990063822 through 19990063824; Original contains color illustrations
Contract(s)/Grant(s): NCC2-982; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This grant funded research on human-computer interaction design and analysis techniques, using future ATC environments as a testbed. The basic approach was to model the nominal behavior of both the automated and human procedures and then to apply safety analysis techniques to these models. Our previous modeling language, RSML, had been used to specify the system requirements for TCAS II for the FAA. Using the lessons learned from this experience, we designed a new modeling language that (among other things) incorporates features to assist in designing less error-prone human-computer interactions and interfaces and in detecting potential HCI problems, such as mode confusion. The new language, SpecTRM-RL, uses "intent" abstractions, based on Rasmussen's abstraction hierarchy, and includes both informal (English and graphical) specifications and formal, executable models for specifying various aspects of the system. One of the goals for our language was to highlight the system modes and mode changes to assist in identifying the potential for mode confusion. Three published papers resulted from this research. The first builds on the work of Degani on mode confusion to identify aspects of the system design that could lead to potential hazards. We defined and modeled modes differently than Degani and also defined design criteria for SpecTRM-RL.

models. Our design criteria include the Degani criteria but extend them to include more potential problems. In a second paper, Leveson and Palmer showed how the criteria for indirect mode transitions could be applied to a mode confusion problem found in several ASRS reports for the MD-88. In addition, we defined a visual task modeling language that can be used by system designers to model human-computer interaction. The visual models can be translated into SpecTRM-RL models, and then the SpecTRM-RL suite of analysis tools can be used to perform formal and informal safety analyses on the task model in isolation or integrated with the rest of the modeled system. We had hoped to be able to apply these modeling languages and analysis tools to a TAP air/ground trajectory negotiation scenario, but the development of the tools took more time than we anticipated.
Author
Human-Computer Interface; Computer Aided Design; User Requirements; Programming Languages; Computer Programming; Computerized Simulation

19990063822 Washington Univ., Computer Science and Engineering, Seattle, WA USA
Analyzing Software Specifications for Mode Confusion Potential
Leveson, Nancy G., Washington Univ., USA; Pinnel, L. Denise, Washington Univ., USA; Sandys, Sean David, Washington Univ., USA; Koga, Shuichi, Washington Univ., USA; Reese, Jon Damon, Washington Univ., USA; Safety Analysis of FMS/CTAS Interactions During Aircraft Arrivals; Dec. 27, 1998; 16p; In English; See also 19990063821
Contract(s)/Grant(s): NAG1-1495; NSF CCR-93-96181; NSF CCR-95-20813; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Increased automation in complex systems has led to changes in the human controller's role and to new types of technology-induced human error. Attempts to mitigate these errors have primarily involved giving more authority to the automation, enhancing operator training, or changing the interface. While these responses may be reasonable under many circumstances, an alternative is to redesign the automation in ways that do not reduce necessary or desirable functionality or to change functionality where the tradeoffs are judged to be acceptable. This paper describes an approach to detecting error-prone automation features early in the development process while significant changes can still be made to the conceptual design of the system. The information about such error-prone features can also be useful in the design of the operator interface, operational procedures, or operator training.
Author
Automatic Control; Complex Systems; Systems Analysis; Reliability Engineering; Systems Engineering

19990063823 NASA Ames Research Center, Moffett Field, CA USA
Designing Automation to Reduce Operator Errors
Leveson, Nancy G., Washington Univ., USA; Palmer, Everett, NASA Ames Research Center, USA; [1997]; 7p; In English; See also 19990063821; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Advanced automation has been accompanied, particularly in aircraft, with a proliferation of modes, where modes define mutually exclusive sets of system behavior. The new mode-rich systems provide flexibility and enhanced capabilities, but they also increase the need for and difficulty of maintaining mode awareness. While automation has eliminated some types of operator mode-awareness errors, it has also created the potential for new types of mode-related problems.
Derived from text
Human-Computer Interface; Human Factors Engineering; Software Engineering; Computer Programming; Software Reliability; Automatic Control; Control Systems Design

19990063824 Washington Univ., Computer Science and Engineering, Seattle, WA USA
Modeling Controller Tasks for Safety Analysis
Brown, Molly, Washington Univ., USA; Leveson, Nancy G., Washington Univ., USA; Safety Analysis of FMS/CTAS Interactions During Aircraft Arrivals; Dec. 27, 1998; 8p; In English; See also 19990063821; Original contains color illustrations
Contract(s)/Grant(s): NAG1-1894; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

As control systems become more complex, the use of automated control has increased. At the same time, the role of the human operator has changed from primary system controller to supervisor or monitor. Safe design of the human computer interaction becomes more difficult. In this paper, we present a visual task modeling language that can be used by system designers to model human-computer interactions. The visual models can be translated into SpecTRM-RL, a blackbox specification language for

modeling the automated portion of the control system. The SpecTRM-RL suite of analysis tools allow the designer to perform formal and informal safety analyses on the task model in isolation or integrated with the rest of the modeled system.
Author
Automatic Control; Aircraft Control; Control Systems Design; Software Development Tools; Architecture (Computers); Computer Systems Design; Human-Computer Interface

19990063849 NASA Glenn Research Center, Cleveland, OH USA
Progress Toward National Aeronautics Goals
Russo, Carlo J., NASA Glenn Research Center, USA; Selura, Arun K., NASA Glenn Research Center, USA; June 1999; 22p; In English; 14th; Air Breathing Engines, 5-10 Sep. 1999, Florence, Italy; Sponsored by International Society for Air Breathing Engines
Contract(s)/Grant(s): RTOP 538-17-11
Report No.(s): NASA/TM-1999-209193; NAS 1.15:209193; E-11707; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA has made definitive progress towards achieving several bold U.S. goals in aeronautics related to air breathing engines. The advanced technologies developed towards these goals span applications from general aviation to large subsonic and supersonic aircraft. The proof of successful technology development is demonstrated through successful technology transfer to U.S. industry and projected fleet impact. Specific examples of progress are discussed that quantifies the achievement towards these goals. In addition, a more detailed vision for NASA aeronautics is defined and key strategic issues are explored which invite international and national debate and involvement especially in reduced environmental impact for subsonic and supersonic aircraft, dramatic new capabilities in general aviation engines, and reduced development cycle time and costs.
Author
Supersonic Aircraft; General Aviation Aircraft; Propulsion; Air Breathing Engines; Technology Transfer

19990063874 Electro Magnetic Applications, Inc., Denver, CO USA
Statistical Study of the Closest Approach of Aircraft to Ground-Based Emitters: Results for Seattle and Comparision with Denver *Final Report*
Elliott, J. R.; Perala, R. A.; Mar. 1999; 54p; In English
Report No.(s): PB99-150112; EMA-97-R-011; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A Technical Program was initiated by the Federal Aviation Administration (FAS) William J. Hughes Technical Center to measure the distances that aircraft fly within high-intensity radiation emitters. This program was launched as the FAA and the High-Intensity Radiated Fields (HIRF) advisory committees were defining HIRF regulatory rulemaking requirements. This study was a follow-on of the work conducted at the Denver International Airport to determine the actual distances that aircraft flew within emitters.
NTIS
Aircraft Hazards; Ground Based Control; Electromagnetic Interference; Airports

19990063915 NASA Langley Research Center, Langley Research Center, Hampton, VA USA
Analyzing Mode Confusion via Model Checking *Final Report*
Luettgen, Gerald, Institute for Computer Applications in Science and Engineering, USA; Carreno, Victor, NASA Langley Research Center, USA; May 1999; 67p; In English
Contract(s)/Grant(s): NAS1-97046
Report No.(s): AD-A364801; NCR-1999-209332; ICASE-RN-9918; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Mode confusion is one of the most serious problems in aviation safety. Today's complex digital flight decks make it difficult for pilots to maintain awareness of the actual states, or modes, of the flight deck automation. NASA Langley leads an initiative to explore how formal techniques can be used to discover possible sources of mode confusion. As part of this initiative, a flight guidance system was previously specified as a finite Mealy automaton, and the theorem prover PVS was used to reason about it. The objective of the present paper is to investigate whether state-exploration techniques, especially model checking, are better able to achieve this task than theorem proving and also to compare several verification tools for the specific application. The flight guidance system is modeled and analyzed in Murphi, SMV, and Spin. The tools are compared regarding their system description

language, their practicality for analyzing mode confusion, and their capabilities for error tracing and for animating diagnostic information. It turns out that their strengths are complementary.
DTIC
Digital Systems; Flight Safety; Aircraft Pilots

19990063996 National Transportation Safety Board, Washington, DC USA
Annual Review of Aircraft Accident Data: U.S. General Aviation, Calendar Year 1996
May 1999; 72p; In English
Report No.(s): PB99-144230; NTSB/ARG-99/01; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
A total of 1,935 U.S. registered general aviation aircraft were involved in 1,907 accidents during calendar year 1996, of these 1,907 accidents, 360 accidents (involving 366 aircraft) resulted in fatal injuries. This report presents a statistical review of these accidents, all involving U.S. registered aircraft that were not conducting air carrier revenue operations under Title 14 Code of Federal Regulations (14 CFR) Parts 121 or 135. The accident data on which this review is based were extracted from the Safety Board's automated Aviation Accident Data System.
NTIS
Aircraft Accidents; General Aviation Aircraft; Aircraft Accident Investigation

19990064249 Electro Magnetic Applications, Inc., Denver, CO USA
Statistical Study of the Distance of Closest Approach of Aircraft to Ground-Based Emitters *Final Report*
Elliott, J. R.; Perala, R. A.; Apr. 1999; 44p; In English
Contract(s)/Grant(s): DTFA 03-96-00036
Report No.(s): PB99-150104; EMA-97-R-007; DOT/FAA/AR-98/75; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
A Technical Program was initiated by the Federal Aviation Administration (FAS) William J. Hughes Technical Center to measure the distances that aircraft fly within high-intensity radiation emitters. This program was launched as the FAA and the High-Intensity Radiated Fields (HIRF) advisory committees were defining HIRF regulatory rule making requirements. This study was conducted at the Denver International Airport to determine the actual closest distances that aircraft fly in proximity to high-intensity radiation emitters.
NTIS
Statistical Analysis; Distance; Emitters; Ground Based Control

19990064541 Federal Aviation Administration, Aviation Security Human Factors, Atlantic City, NJ USA
Screener Readiness Tes - Validation Pilot Testing
Neiderman, E. C.; Fobes, J. L.; Apr. 1999; 20p; In English
Report No.(s): PB99-146425; DOT/FAA/AR-99/37; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The Screener Readiness Test is a computer-based assessment instrument being developed to test new checkpoint screener candidates after they have been given their initial training. The instrument's computer interface was evaluated as part of the validation process and found to be relatively easy to use. Several revisions needed for the interface are described before the full-scale validation is undertaken.
NTIS
Human Performance; Computer Techniques

19990064562 NASA Ames Research Center, Moffett Field, CA USA
Reconstruction of the 1994 Pittsburgh Airplane Accident Using a Computer Simulation
Parks, Edwin K., Arizona Univ., USA; Bach, Ralph E., Jr., NASA Ames Research Center, USA; Shin, Jae Ho, Arizona Univ., USA; 1998; 8p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): NCC2-329
Report No.(s): AIAA Paper 98-0503; Copyright; Avail: Issuing Activity, Hardcopy
On September 8, 1994, a Boeing 737-300 passenger airplane was on a downwind approach to the Pittsburgh International Airport at an altitude of 5000 feet above ground level (6000 feet MSL). While in a shallow left turn onto a downwind approach heading, the airplane crossed into the vortex trail of a Boeing 727 flying in the same approach pattern about 4 miles ahead. The B-737 airplane rolled and turned sharply to the left, exited the vortex wake and plunged into the ground. Weather was not a factor in the accident. The airplane was equipped with a 114 channel digital Flight Data Recorder (FDR) and a multiple channel Cockpit

Voice Recorder (CVR). Both recorders were recovered from the crash site and provided excellent data for the development of an accident scenario. Radar tracking of the two airplanes as well as the indicated air speed (IAS) perturbations clearly visible on the B-737 FDR recordings indicate that the upset was apparently initiated by the airplane's crossing into the wake of the B-727 flying ahead in the same traffic pattern. A 6 degree-of-freedom simulation program for the B-737 airplane using MATLAB and SIMULINK was constructed. The simulation was initialized at the stabilized flight conditions of the airplane about 13 seconds prior to its entry into the vortex trail of the B-727 airplane. by assuming a certain combination of control inputs, it was possible to produce a simulated motion that closely matched that recorded on the FDR.
Author
Aircraft Accidents; Airspeed; Crashes; Crossings; Flight Recorders

19990067248 Science Applications International Corp., Arlington, VA USA
VFR Heliport Operations in an Obstacle-Rich Environment (ORE) *Final Report*
Sawyer, Brian M., Science Applications International Corp., USA; Boiz, Eric H., Science Applications International Corp., USA; Daum, James M., Boeing Defense and Space Group, USA; Grenell, James F., Boeing Defense and Space Group, USA; Wilkinson, Paul R., Boeing Defense and Space Group, USA; Zmroczek, Leon A., Boeing Defense and Space Group, USA; May 1999; 272p; In English
Contract(s)/Grant(s): DTFA01-93-C-00030
Report No.(s): AD-A364938; ATSO-97R-2; DOT/FAA/ND-98/3; No Copyright; Avail: CASI; A03, Microfiche; A12, Hardcopy

This investigation studied helicopter pilot performance and perception in a visual flight rule (VFR) heliport terminal obstacle-rich environment (ORE). Simulations were conducted in September and October 1996 as part of a larger effort focused on examining operational safety at U.S. heliports. Concerns raised by pilots operating at a city-center heliport motivated the study. Although none of the obstacles at this heliport protruded into the minimum recommended approach/departure airspace, pilots and their management complained of safety concerns when operating there. The ORE program was sponsored by the General Aviation and Vertical flight Program Office (AND-710) of the Federal Aviation Administration (FAA). As the primary support contractor to AND-710, Science Applications International Corporation's (SAIC) Air Transportation Systems Operation (ATSO) assembled a research team. Boeing Defense & Space Group, Helicopters Division, as simulation support subcontractor, lead the team conducting the simulation experiment.
DTIC
Pilots (Personnel); Visual Flight Rules; Vertical Flight; Helicopters

19990069723 Royal Aeronautical Society, London, UK
Future Development in Ice Protection: Proceedings
Operation in Snow and Icing Conditions-Reducing the Risk; 1998; In English; Future Development in Ice Protection, 21 May 1998, London, UK; See also 19990069724 through 19990069728; ISBN 1-85768-049-9; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

Contents include the following: operation in snow and icing conditions -reducing the risk; certification - the UK perspective; meteorological aspects of aircraft icing; ice protection system flight testing and compliance with the certification requirements; and icing operational issues for turboprop aircraft and helicopters.
CASI
Certification; Deicing; Ice Formation; Ice Prevention; Turboprop Aircraft; Procedures

19990069724 Defence Evaluation Research Agency, Rotary Wing Aircraft Dept., Boscombe Down, UK
Operation in Snow and Icing Conditions: Reducing the Risk
Curtis, Ray, Defence Evaluation Research Agency, UK; Future Development in Ice Protection: Proceedings; 1998; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

DERA Boscombe's experience in the field of clearing military rotorcraft for operation in snow and icing now spans almost 40 years, with virtually all UK Military helicopter types having undergone at least one winter season testing in these conditions at sites in North America or Europe. This paper will provide a little historical information based on my own recollections and involvement in these DERA trials and some undertaken by others. I shall include a very brief description of the difficulties we have found operating helicopters in snow and icing and will then give an insight into some of the more interesting findings, test techniques and instrumentation used. Such techniques and instrumentation were developed and employed by DERA to improve our understanding of the conditions and the affects on the aircraft in order to reduce the risk associated with any icing or snow flying clearance granted. The paper will then pose a few questions that stem from fixed and rotary wing aircraft incidents and

accidents that have occurred in recent years. At its end, it will provide my personal "wish list" that perhaps if satisfied would enhance rotorcraft safety in snow and icing conditions: some of which may also have relevance to fixed wing aircraft.
Author
Clearances; Snow; Ice Formation; Safety; Risk; Histories

19990069725 Civil Aviation Authority, Gatwick, UK
Certification: The UK Perspective
Barrow, Cliff, Civil Aviation Authority, UK; 1998; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

This paper presents a brief review of the UK CAA's research and action over recent years in response to experience of accidents and incidents in the nineteen eighties. Three general areas are identified, namely icing atmosphere, ice detection, and pneumatic boot de-icing systems. The recent initiatives instigated under the FAA Icing Plan and the ARAC Harmonisation process have highlighted some of these areas which are now subject to comprehensive review with respect to developing revised and/or new airworthiness requirements. The UK CAA strongly supports this activity which has the potential for significant improvements in certification and operational standards. However, the tasks identified for this work will require fundamental examination of the implications of moving from the existing objective requirements to those of a more prescriptive nature, including their effect on certification of different aircraft types and the means of demonstrating compliance.
Author
Research; Deicers; Detection; Accident Prevention

19990069726 Meteorological Office, Bracknell, UK
Meteorological Aspects of Aircraft Icing
Brown, Roderick, Meteorological Office, UK; 1998; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

Renewed interest in aircraft icing has arisen because of the recent realization of the significant hazard posed by supercooled large drops (diameter greater than 100 microns). The processes governing the occurrence of supercooled water are reviewed. The two mechanisms for producing supercooled large drops (SLD) are described These are the melting of ice crystals followed by the resultant drop falling into a sub-zero layer and the coalescence of cloud drops to produce supercooled drizzle drops. The latter mechanism is now thought to be more widespread than the former. The EC funded EURICE project is described. This has involved the establishment of two data bases, one containing accident/incident reports and the other microphysical data. The existing microphysical data have been found to be mainly compatible with JAA/FAA Appendix C. Analysis of selected accidents/incidents over Europe suggests SLD involvement in many. New flights have also been undertaken on most of which some SLD were sampled. These were mainly associated with convection embedded in layer cloud or with gravity waves in layer cloud. Finally, recent work on forecasting is summarized.
Author
Aircraft Icing; Meteorological Parameters; Drop Size; Hazards; Crystals; Convection Clouds; Accidents

19990069727 British Aerospace Airbus Ltd., Woodford, UK
Ice Protection System Flight Testing and Compliance With the Certification Requirements
Future Development in Ice Protection: Proceedings; 1998; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

Despite improvements in design and test techniques, icing related accidents, incidents and operating problems continue to occur regularly in service. Current methods of analysis to predict ice accretions and their effect on aircraft handling and performance have limitations, even within the existing design envelope. There are also significant limitations with all methods of simulating in-flight icing. Whilst natural icing tests are the only method of realistically assessing the operation of an aircraft in icing conditions, due to its nature, icing is often extremely difficult to find and quantify. The opportunities to fly the aircraft in the extreme conditions which may cause accidents therefore rarely occur during flight testing. Changes in certification requirements now necessitate the manufacturer to carry out a much more in-depth assessment of the aircraft handling in icing conditions. However, it should be appreciated that it is still not possible to guarantee that testing has been carried out in the most extreme conditions which may be encountered in service. Consideration is currently being given to extending the envelope of design icing conditions. However, without major improvements in analytical techniques and methods of simulation there will be limited benefits
Author
Aircraft Icing; Design Analysis; Protective Coatings; Flight Tests; Certification

19990069728 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering and Transport Studies, UK

Icing Operational Issues for Turboprop Aircraft and Helicopters

Simpson, Mark P., Loughborough Univ. of Technology, UK; Render, Peter M., Loughborough Univ. of Technology, UK; Future Development in Ice Protection: Proceedings; 1998, pp. 7.1 - 7.11; In English; See also 19990069723; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, WiV 0BQ, UK), Hardcopy, Microfiche

The hazards associated with operating turboprop aircraft and helicopters in icing conditions are well known and documented. However, icing related incidents and accidents still occur. This paper presents information gathered from turboprop and helicopter manufacturers and operators in Europe and Canada on the certification and operation of turboprop aircraft and helicopters in icing conditions. The following recommendations are made; (1) Develop a low-cost icing training package applicable to both turboprop aircraft and helicopters. (2) Carry out an investigation as to whether ice bridging occurs with modern pneumatic boot designs. (3) That ice protection methods should be improved and that development costs be shared by a consortium of manufacturers, authorities and research organisations. (4) That an ice prediction probe be developed, which warns the aircrew that they will soon be entering icing conditions. (5) to make weather forecasts more accurate, reliable and descriptive as to how the aircraft will be affected by icing and to consider the installation of telemetry equipment on aircraft to provide information for "now casts". (6) That improvements be made to pilot training by increasing the fidelity of the icing model on turboprop and helicopter simulators. Author

Ice Prevention; Certification; Weather Forecasting; Turboprop Aircraft; Ice Formation; Helicopters; Hazards; Deicing

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19990063756 Technion - Israel Inst. of Tech., Faculty of Aerospace Engineering, Haifa, Israel

Advanced Interactive Display Formats for Terminal Area Traffic Control *Final Report, 1 Feb. 1998 - 31 Jan. 1999*

Grunwald, Arthur J., Technion - Israel Inst. of Tech., Israel; Shaviv, G. E., Technion - Israel Inst. of Tech., Israel; Jun. 15, 1999; 132p; In English

Contract(s)/Grant(s): NCC2-1023; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This research project deals with an on-line dynamic method for automated viewing parameter management in perspective displays. Perspective images are optimized such that a human observer will perceive relevant spatial geometrical features with minimal errors. In order to compute the errors at which observers reconstruct spatial features from perspective images, a visual spatial-perception model was formulated. The model was employed as the basis of an optimization scheme aimed at seeking the optimal projection parameter setting. These ideas are implemented in the context of an air traffic control (ATC) application. A concept, referred to as an active display system, was developed. This system uses heuristic rules to identify relevant geometrical features of the three-dimensional air traffic situation. Agile, on-line optimization was achieved by a specially developed and custom-tailored genetic algorithm (GA), which was to deal with the multi-modal characteristics of the objective function and exploit its time-evolving nature.

Author

Air Traffic Control; On-Line Systems; Display Devices; Visual Perception; Genetic Algorithms; Heuristic Methods; Management Systems; Automatic Control

19990063852 NASA Goddard Space Flight Center, Greenbelt, MD USA

Fast Integer Ambiguity Resolution for GPS Attitude Determination

Lightsey, E. Glenn, Texas Univ., USA; Crassidis, John L., Texas A&M Univ., USA; Markley, F. Landis, NASA Goddard Space Flight Center, USA; 1999; 11p; In English; Guidance, Navigation and Control, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics

Contract(s)/Grant(s): NAG5-7130

Report No.(s): AIAA Paper 99-3967; Copyright; Avail: Issuing Activity, Hardcopy

In this paper, a new algorithm for GPS (Global Positioning System) integer ambiguity resolution is shown. The algorithm first incorporates an instantaneous (static) integer search to significantly reduce the search space using a geometric inequality. Then a batch-type loss function is used to check the remaining integers in order to determine the optimal integer. This batch function represents the GPS sightline vectors in the body frame as the sum of two vectors, one depending on the phase measurements and the other on the unknown integers. The new algorithm has several advantages: it does not require an a-priori

estimate of the vehicle's attitude; it provides an inherent integrity check using a covariance-type expression; and it can resolve the integers even when coplanar baselines exist. The performance of the new algorithm is tested on a dynamic hardware simulator.
Author
Global Positioning System; Space Navigation; Spacecraft Guidance; Attitude (Inclination)

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19990063722 NASA Marshall Space Flight Center, Huntsville, AL USA
X-34 Program
Springer, A. M., NASA Marshall Space Flight Center, USA; 1999; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The X-34 is an Reusable Launch Vehicle (RLV) Operations testbed. The goal of the program is to examine some critical issues in the area of RLV's: (1) Operations cost (i.e., Can the time and manpower needed to process an RLV be reduced); (2) Advanced technologies (i.e., How will new technologies perform in an operational environment); (3) RLV range support (i.e., Can we tailor range support to reduce cost?); (4) Integrated Vehicle Health Monitoring (IVHM) (i.e., Can the use of a IVHM reduce cycle time and therefore time?). This presentation reviews these issues, and presents diagrams and pictures of the X-34.
CASI
X-34 Reusable Launch Vehicle; Reusable Spacecraft; Composite Propellants; Spacecraft Propulsion; Avionics; Systems Health Monitoring; Rocket Engines; Reentry Shielding; Thermal Protection

19990063728 Florida Univ., Dept. of Aerospace Engineering, Gainesville, FL USA
Efficient Approximation for Structural Optimization Under Multiple Constraints *Final Report, Aug. 1995 - Aug. 1997*
Haftka, Raphael T., Florida Univ., USA; November 1997; 21p; In English
Contract(s)/Grant(s): NCC1-216; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The cooperative agreement covered work between August 1995 and August 1997. The focus of the work was efficient approximations of structural response and sensitivity. The effort proceeded in three directions as follows: (1) Development of an approximation extended to efficient sensitivity approximations and demonstrated for structural models for the High Speed Civil Transport; (2) Preliminary development of the adjoint method for calculating sensitivity derivatives; and (3) A review of method for fast exact reanalysis. Attachments of papers which were submitted during this period are included.
Author
Approximation; Optimization; Structural Analysis

19990063748 NASA Langley Research Center, Hampton, VA USA
An Overview of Landing Gear Dynamics
Pritchard, Jocelyn I., NASA Langley Research Center, USA; 1999; 16p; In English; Aeroelasticity and Structural Dynamics, 22-25 Jun. 1999, Williamsburg, VA, USA; Sponsored by NASA Langley Research Center, USA; Copyright; Avail: Issuing Activity, Hardcopy

One of the problems facing the aircraft community is landing gear dynamics, especially shimmy and brake-induced vibration. Although neither shimmy nor brake-induced vibrations are usually catastrophic, they can lead to accidents due to excessive wear and shortened life of gear parts and contribute to pilot and passenger discomfort. Recently, NASA has initiated an effort to increase the safety of air travel by reducing the number of accidents by a factor of five in ten years. This safety initiative has spurred an increased interest in improving landing gear design to minimize shimmy and brake-induced vibration that are still largely misunderstood phenomena. In order to increase the understanding of these problems, a literature survey was performed. The major focus of the paper is to summarize work documented from the last ten years to highlight the latest efforts in solving these vibration problems. Older publications are included to understand the longevity of the problem and the findings from earlier researchers. The literature survey revealed a variety of analyses, testing, modeling, and simulation of aircraft landing gear. Experimental validation and characterization of shimmy and brake-induced vibration of aircraft landing gear are also reported. This paper presents an overview of the problem documented in the references together with a history of landing gear dynamic problems and

solutions. Based on the assessment of this survey, recommendations of the most critically needed enhancements to the state of the art are given.
Author
Landing Gear; Aircraft Landing; Vibration; Wear

19990063780 NASA Dryden Flight Research Center, Edwards, CA USA
Airdata Measurement and Calibration
Haering, Edward A., Jr., NASA Dryden Flight Research Center, USA; Introduction to Flight Test Engineering; December 1995; Volume 1, Section 11; 19p; In English
Contract(s)/Grant(s): RTOP 533-02-51
Report No.(s): NASA-TM-104316; H-2044; NAS 1.15:104316; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This memorandum provides a brief introduction to airdata measurement and calibration. Readers will learn about typical test objectives, quantities to measure, and flight maneuvers and operations for calibration. The memorandum informs readers about tower-flyby, trailing cone, pacer, radar-tracking, and dynamic airdata calibration maneuvers. Readers will also begin to understand how some data analysis considerations and special airdata cases, including high-angle-of-attack flight, high-speed flight, and nonobtrusive sensors are handled. This memorandum is not intended to be all inclusive; this paper contains extensive reference and bibliography sections.
Author
Calibrating; Air Data Systems; Data Processing; Dynamic Characteristics; Velocity Measurement

19990063878 Space and Naval Warfare Systems Center, San Diego, CA USA
Unmanned Air Vehicle Impacton CVX Design *Final Report, Sep. 98*
Estabrook, A.; Mac Dougall, R.; Ludwig, R.; Sep. 1998; 39p; In English
Report No.(s): AD-A364160; TD-3042; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Naval Sea Systems Command (NAVSEA) CVX Program Office, PMS-378, is conducting a series of trade-off studies to provide the necessary inputs for the creation of the Operational Requirements Document (ORD) for the Tactical Aviation (TACAIR) sea-based platform for the 21st century, the CVX. SSC San Diego, UAV Project Office, has been assigned two of these studies. This study is the second of the two studies, addressing general operational and physical design characteristics required to incorporate unmanned aerial vehicles (UAVs) organic to CVX operations. Analysis includes both operations from a detachment standpoint (four airframes) and from a squadron standpoint (12 airframes). Potential impact areas include CVX deck structure, launch capabilities, recovery methods, maintenance spaces, storage spaces, personnel living spaces, command and control spaces and workstations, communications and data transmission paths, and ship antennae requirements.
DTIC
Remotely Piloted Vehicles; Pilotless Aircraft; Research

19990063879 Space and Naval Warfare Systems Center, San Diego, CA USA
Unmanned Air Vehicle Impact on CVX Design *Final Report, Sep. 98*
Estabrook, A.; Mac Dougall, R.; Ludwig, R.; Sep. 1998; 40p; In English
Report No.(s): AD-A364159; TD-3042; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The Naval Sea Systems Command (NAVSEA) CVX Program Office, PMS-378, is conducting a series of trade-off studies to provide the necessary inputs for the creation of the Operational Requirements Document (ORD) for the Tactical Aviation (TACAIR) sea-based platform for the 21st century, the CVX. SSC San Diego, UAV Project Office, has been assigned two of these studies. This study is the second of the two studies, addressing general operational and physical design characteristics required to incorporate unmanned aerial vehicles (UAVs) organic to CVX operations. Analysis includes both operations from a detachment standpoint (four airframes) and from a squadron standpoint (12 airframes). Potential impact areas include CVX deck structure, launch capabilities, recovery methods, maintenance spaces, storage spaces, personnel living spaces, command and control spaces and workstations, communications and data transmission paths, and ship antennae requirements.
DTIC
Remotely Piloted Vehicles; Pilotless Aircraft; Research; Design Analysis; Command and Control; Maintenance; Data Transmission

19990063963 Synectics Corp., Rome, NY USA

Modular Avionics Test Equipment (Mate 390) Test Program Set (TPS) Demonstration *Final Report, Sep. 1996 - Apr. 1998*

Krinsky, Jerry; Haritatos, Cheryl; May 1999; 10p; In English; Prepared in cooperation with Instrumentation Engineering, Wayne, NJ.

Contract(s)/Grant(s): F30602-95-D-0028; AF Proj. 2982

Report No.(s): AD-A364080; WH94RY08-A002; AFRL-IF-RS-TR-1999-92; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this task was to upgrade and enhance the existing 390 testers at Kelly AFB to expand system life expectancy to ensure maintainability and supportability. This was accomplished by replacing existing processors with state-of-the-art commercial off-the-shelf (COTS) Pentium processors and providing software upgrades to maintain system operational capability with the existing Test Program Sets (TPSs). The IE 390 upgraded test stations now have a common hardware configuration and use the same version of software. System training and demonstrations were provided to familiarize Air Force engineers with the operation and capability of the upgraded systems. The open architecture of the upgraded 390 hardware and software also allows easier future COTS upgrades.

DTIC

Test Facilities; Avionics

19990063984 Notre Dame Univ., Dept. of Aerospace and Mechanical Engineering, IN USA

Multidisciplinary Design Technology Development: A Comparative Investigation of Integrated Aerospace Vehicle Design Tools, *1 Jan. 1997 - 30 Sep. 1998*

Renaud, John E., Notre Dame Univ., USA; Batill, Stephen M., Notre Dame Univ., USA; Brockman, Jay B., Notre Dame Univ., USA; 1998; 10p; In English

Contract(s)/Grant(s): NAG1-1561; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This research effort is a joint program between the Departments of Aerospace and Mechanical Engineering and the Computer Science and Engineering Department at the University of Notre Dame. Three Principal Investigators; Drs. Renaud, Brockman and Batill directed this effort. During the four and a half year grant period, six Aerospace and Mechanical Engineering Ph.D. students and one Masters student received full or partial support, while four Computer Science and Engineering Ph.D. students and one Masters student were supported. During each of the summers up to four undergraduate students were involved in related research activities. The purpose of the project was to develop a framework and systematic methodology to facilitate the application of Multidisciplinary Design Optimization (MDO) to a diverse class of system design problems. For all practical aerospace systems, the design of a systems is a complex sequence of events which integrates the activities of a variety of discipline "experts" and their associated "tools". The development, archiving and exchange of information between these individual experts is central to the design task and it is this information which provides the basis for these experts to make coordinated design decisions (i.e., compromises and trade-offs) - resulting in the final product design. Grant efforts focused on developing and evaluating frameworks for effective design coordination within a MDO environment. Central to these research efforts was the concept that the individual discipline "expert", using the most appropriate "tools" available and the most complete description of the system should be empowered to have the greatest impact on the design decisions and final design. This means that the overall process must be highly interactive and efficiently conducted if the resulting design is to be developed in a manner consistent with cost and time requirements. The methods developed as part of this research effort include; extensions to a sensitivity based Concurrent Subspace Optimization (CSSO) MDO algorithm; the development of a neural network response surface based CSSO-MDO algorithm; and the integration of distributed computing and process scheduling into the MDO environment. This report overviews research efforts in each of these focus. A complete bibliography of research produced with support of this grant is attached.

Derived from text

Multidisciplinary Design Optimization; Systems Engineering; Aerospace Systems; Design Analysis; Information Management; Information Transfer

19990064157 Pennsylvania State Univ., Dept. of Aerospace Engineering, University Park, PA USA

Understanding the Potential of Aeroelastic Couplings to Stabilize Ground and Air Resonance in a Soft-Inplane Tiltrotor *Final Report*

Howard, Anna K. T., Pennsylvania State Univ., USA; Jun. 04, 1999; 87p; In English

Contract(s)/Grant(s): NGT1-52109; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The tiltrotor offers the best mix of hovering and cruise flight of any of the current V/STOL configurations. One possible improvement on the tiltrotors of today designs would be using a soft-inplane hingeless hub. The advantages to a soft-inplane hingeless hub range from reduced weight and maintenance to reduced vibration and loads. However, soft-inplane rotor systems

are inherently in danger of the aeromechanical instabilities of ground and air resonance. Furthermore tiltrotors can be subject to whirl flutter. At least in part because of the potential for air and ground resonance in a soft-inplane rotor, the Bell XV-15, the Bell-Boeing V-22 Osprey, and the new Bell Augusta 609 have stiff-inplane, gimballed rotors which do not experience these instabilities. In order to design soft-inplane V/STOL aircraft that do not experience ground or air resonance, it is important to be able to predict these instabilities accurately. Much of the research studying the stability of tiltrotors has been focused on the understanding and prediction of whirl flutter. As this instability is increasingly well understood, air and ground resonance for a tiltrotor need to be investigated. Once we understand the problems of air and ground resonance in a tiltrotor, we must look for solutions to these instabilities. Other researchers have found composite or kinematic couplings in the blades of a helicopter helpful for ground and air resonance stability. Tiltrotor research has shown composite couplings in the wing to be helpful for whirl flutter. Therefore, this project will undertake to model ground and air resonance of a soft-inplane hingeless tiltrotor to understand the mechanisms involved and to evaluate whether aeroelastic couplings in the wing or kinematic couplings in the blades would aid in stabilizing these instabilities in a tiltrotor.

Author

Rotors; Ground Resonance; Aeroelasticity; Couplings; Aerodynamic Forces; Rotor Aerodynamics; Aerodynamic Stability; Flutter Analysis; Tilt Rotor Aircraft

19990064384 North Carolina Agricultural and Technical State Univ., Dept. of Mechanical Engineering, Greensboro, NC USA

Structural Integrity of Discontinuous Stiffened Integrally Braided and Woven Composite Panels *Final Report*

Shivakumar, K. N.; Sundaresan, M. J.; Avva, V. S.; Mar. 1999; 66p; In English

Contract(s)/Grant(s): FAA 95-G-013

Report No.(s): PB99-150088; DOT/FAA/AR-99/24; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The strength and failure modes of discontinuous blade stiffened panels made of textile perform composites (three-dimensional (3D) braided (0 deg +/-17 deg) and 3D orthogonal woven (0 deg/90deg/90deg)) were evaluated through 3D finite element analysis and test. Tests were conducted under quasi-static tensile and tension-tension fatigue conditions. The peel and shear stresses at the notch root were as high as 40% and 80% of the axial stress, and they caused failure initiation. Final static fracture in both braided woven composite panels were by net section tensile failure.

NTIS

Braided Composites; Composite Structures; Woven Composites; Aircraft Construction Materials; Panels; Stiffening

19990064483 Lembaga Penerbangan dan Antariksa Nasional, Peneliti Bidang Kendali Roket dan Satelit, Jakarta, Indonesia

Effects of Maneuver Input Form and Noise Measurements on Dynamic Parameter Estimates from Flight Test Data *Pengaruh Bentuk Input Manuver Dan Noise Pengukuran Terhadap Estimasi Parameter Dinamik Dari Data Uji Terbang*

Sofyan, Edi, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Warta LAPAN; April 1998; ISSN 0126-9754, No. 55, pp. 28-35; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper examines the effect of various input maneuvers to the results of the parameter identification process in extracting ASCD (Aerodynamic Stability and Control Derivatives) of DARSAT-1 (The RPV developed at The Division of Aerospace Technology Development, LAPAN) from flight data. In addition, the effect of the measured noise contained in the flight data was also studied. Linear regression and Maximum Likelihood algorithms were used in extracting the ASCD. The result of the analysis concluded that the type of input maneuver necessary to conduct dynamic flight test was not very strict Basically, any type of pulse or doublet input could be used to excite the motion under investigation, e.g. SPO or Dutch mode. Also, from the study of the presence of measurement noise in the flight data using the sensor characteristics which were obtained from calibrations, indicated that the quality of the sensor's noise was acceptable to be used in measuring flight test data. The level of noise was not so significant to degrade the result of the parameter identification.

Author

Noise Measurement; Dynamic Tests; Flight Tests; Data Acquisition; Remotely Piloted Vehicles

19990064496 Mississippi State Univ., Dept. of Aerospace Engineering, Mississippi State, MS USA

Global-Local Analysis and Optimization of a Composite Civil Tilt-Rotor Wing

Rais-Rohani, Masound, Mississippi State Univ., USA; [1999]; 21p; In English

Contract(s)/Grant(s): NAG1-1571; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report gives highlights of an investigation on the design and optimization of a thin composite wing box structure for a civil tilt-rotor aircraft. Two different concepts are considered for the cantilever wing: (a) a thin monolithic skin design, and (b) a thick sandwich skin design. Each concept is examined with three different skin ply patterns based on various combinations of 0, +/-45, and 90 degree plies. The global-local technique is used in the analysis and optimization of the six design models. The

global analysis is based on a finite element model of the wing-pylon configuration while the local analysis uses a uniformly supported plate representing a wing panel. Design allowables include those on vibration frequencies, panel buckling, and material strength. The design optimization problem is formulated as one of minimizing the structural weight subject to strength, stiffness, and dynamic constraints. Six different loading conditions based on three different flight modes are considered in the design optimization. The results of this investigation reveal that of all the loading conditions the one corresponding to the rolling pull-out in the airplane mode is the most stringent. Also the frequency constraints are found to drive the skin thickness limits, rendering the buckling constraints inactive. The optimum skin ply pattern for the monolithic skin concept is found to be ((0/4/-45/90/(0/90)(sub 2))(sub s))(sub s), while for the sandwich skin concept the optimal ply pattern is found to be ((0/4/-45/90)(sub 2s))(sub s).

Author

Design Analysis; Wing Panels; Aerodynamic Configurations; Mathematical Models; Mechanical Properties; Models; Optimization

19990064560 NASA Langley Research Center, Hampton, VA USA

Force and Moment Approach for Achievable Dynamics Using Nonlinear Dynamic Inversion

Ostroff, Aaron J., NASA Langley Research Center, USA; Bacon, Barton J., NASA Langley Research Center, USA; 1999; 14p; In English; Guidance, Navigation, and Control, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-4001; Copyright; Avail: Issuing Activity, Hardcopy

This paper describes a general form of nonlinear dynamic inversion control for use in a generic nonlinear simulation to evaluate candidate augmented aircraft dynamics. The implementation is specifically tailored to the task of quickly assessing an aircraft's control power requirements and defining the achievable dynamic set. The achievable set is evaluated while undergoing complex mission maneuvers, and perfect tracking will be accomplished when the desired dynamics are achievable. Variables are extracted directly from the simulation model each iteration, so robustness is not an issue. Included in this paper is a description of the implementation of the forces and moments from simulation variables, the calculation of control effectiveness coefficients, methods for implementing different types of aerodynamic and thrust vectoring controls, adjustments for control effector failures, and the allocation approach used. A few examples illustrate the perfect tracking results obtained.

Author

Dynamic Control; Aerodynamic Characteristics; Flight Characteristics; Inversions; Nonlinearity

19990064577 NASA Langley Research Center, Hampton,VA USA

Sensitivity Analysis for Coupled Aero-structural Systems

Giunta, Anthony A., NASA Langley Research Center, USA; August 1999; 23p; In English; Original contains color illustration

Contract(s)/Grant(s): RTOP 509-10-11-04

Report No.(s): NASA/TM-1999-209367; L-17890; NAS 1.15.209367; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A novel method has been developed for calculating gradients of aerodynamic force and moment coefficients for an aeroelastic aircraft model. This method uses the Global Sensitivity Equations (GSE) to account for the aero-structural coupling, and a reduced-order modal analysis approach to condense the coupling bandwidth between the aerodynamic and structural models. Parallel computing is applied to reduce the computational expense of the numerous high fidelity aerodynamic analyses needed for the coupled aero-structural system. Good agreement is obtained between aerodynamic force and moment gradients computed with the GSE/modal analysis approach and the same quantities computed using brute-force, computationally expensive, finite difference approximations. A comparison between the computational expense of the GSE/modal analysis method and a pure finite difference approach is presented. These results show that the GSE/modal analysis approach is the more computationally efficient technique if sensitivity analysis is to be performed for two or more aircraft design parameters.

Author

Design Analysis; Aerodynamic Forces; Aerodynamic Coefficients; Aircraft Design; Sensitivity; Structural Analysis

19990064639 Naval Postgraduate School, Monterey, CA USA

Enhancing Readiness of the Unmanned Aerial Vehicle (UAV) System via Use of Simulation Modeling and Contract Incentives

Kasal, Omer Emre; Jun. 1999; 138p; In English

Report No.(s): AD-A365340; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The two most important reasons for the inefficiency in the Unmanned Aerial Vehicle (UAV) test system of the Turkish Army Command are the failure to address life cycle cost (LCC) considerations during financial resource allocations and the absence of contract reliability incentives. These problems are not uncommon to newly developed major weapon systems. The objective of this thesis is to develop a life cycle cost based decision support tool and a performance incentive fee contracting model to improve the operational availability of the UAV system. This thesis integrates the spare parts, and repair and replacement cost considerations into life cycle cost calculation of the UAV system and establishes a methodology to determine these costs by exploring the relationship among spare level, service and failure rate in terms of readiness. An increase in the stock level does not improve the UAV system's efficiency in the long run. This thesis also provides a tool for the computation of a performance incentive fee by using modeling and simulation. This study presents a computer aided decision Support tool for more efficient and effective allocation of scarce resources.

DTIC

Pilotless Aircraft; Decision Support Systems; Life Cycle Costs; Computerized Simulation; Computer Techniques

19990066715 NASA Ames Research Center, Moffett Field, CA USA

A Coupled Aero-Structural Optimization Method for Complete Aircraft Configurations

Reuther, J., MCAT Inst., USA; Alonso, J. J., Stanford Univ., USA; Martins, J. R. R. A., Stanford Univ., USA; Smith, Stephen C., NASA Ames Research Center, USA; 1999; 64p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA

Contract(s)/Grant(s): NCC2-5226

Report No.(s): AIAA Paper 99-0187; Copyright; Avail: Issuing Activity, Hardcopy

This paper presents a new framework for the coupled optimization of aero-structural systems. The framework permits the use of high-fidelity modeling of both the aerodynamics and the structures and represents our first step in an effort towards the development of a high-fidelity multidisciplinary optimization capability. The approach is based on efficient analysis methodologies for the solution of the aerodynamics and structures subproblems, an adjoint solver to obtain aerodynamic sensitivities, and a multiprocessor parallel implementation. We have placed a geometry database representing the outer mold line (OML) of the configuration of interest at the core of our framework. Using this geometry description, the information exchange between aerodynamics and structures is accomplished through an independent coupling of each discipline with the OML database. The framework permits the later inclusion of other disciplines, such as heat transfer and radar signatures, with relative ease. Specific results from the coupling of a finite volume flow solver for the Euler and Reynolds Averaged Navier-Stokes equation with two different linear finite element structural models are explored. Care is taken in the treatment of the coupling of the disciplines such that a consistent and conservative scheme is achieved. Direct comparisons with wind-tunnel data are presented to demonstrate the importance of aeroelastic solutions. IN addition, simplified design examples are presented to illustrate the possible advantages of the new aero-structural design methodology in evaluating trade-offs between aerodynamic performance and structural weight for complete aircraft configurations.

Author

Couples; Aerodynamic Characteristics; Aircraft Configurations; Technology Assessment; Optimization; Structural Design

19990067843 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Analytical Calculations of Helicopter Torque Coefficient (CQ) and Thrust Coefficient (CT) Values for the Helicopter Performance (HELPE) Model *Final Report*

Kim, Ki C.; Jun. 1999; 29p; In English

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A365512; ARL-TR-1986; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A computer program for calculating helicopter torque coefficients (CQ) and thrust coefficients (CT) as a function of a vehicle's forward speed has been developed in conjunction with the helicopter performance assessment project. The model is based on the energy principle, in which helicopter power is broken into three components: induced power, profile power, and parasite power. This report documents the basic mathematical model used in the code, along with the numerical solution scheme used in implementing the model. Results are calculated for the UH-60A Black Hawk helicopter for hover and different forward speed settings and correlated with existing flight test data. The effects of different disk loading on helicopter power requirements are also investigated. The present model agrees reasonably well with the flight test data, providing the author with a certain confidence in the helicopter aerodynamic model developed in the present study.

DTIC

Helicopter Performance; Performance Prediction; UH-60A Helicopter; Thrust; Torque; Flight Tests

19990069226 NASA Marshall Space Flight Center, Huntsville, AL USA

X-33 Program Overview

Naftel, J. Chris, NASA Marshall Space Flight Center, USA; May 17, 1999; In English; International Space University, 9-14 Aug. 1999, Nakhon Ratchasima, Thailand

Contract(s)/Grant(s): NCC8-115; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An X-33 program overview is presented in viewgraph form. The objective of the research was to build and test a 50% scale prototype of an operational Reusable Launch Vehicle in a realistic flight environment. Technologies to be demonstrated include reusable cryogenic tankage, composite structures, durable thermal protection systems, advanced avionics, reliable propulsion systems, and aircraft-like operations.

Derived from text

Prototypes; X-33 Reusable Launch Vehicle; Spacecraft Design; NASA Space Programs

19990069624 Rockwell International Corp., North American Aircraft, Seal Beach, CA USA

New Approaches to HSCT Multidisciplinary Design and Optimization *Interim Report, Jan. 1996 - Jan. 1997*

Schrage, D. P., Rockwell International Corp., USA; Craig, J. I., Rockwell International Corp., USA; Fulton, R. E., Lockheed Aeronautical Systems Co., USA; Mistree, F., Lockheed Aeronautical Systems Co., USA; January 1997; 21p; In English

Contract(s)/Grant(s): NGT1-51102; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The successful development of a capable and economically viable high speed civil transport (HSCT) is perhaps one of the most challenging tasks in aeronautics for the next two decades. At its heart it is fundamentally the design of a complex engineered system that has significant societal, environmental and political impacts. As such it presents a formidable challenge to all areas of aeronautics, and it is therefore a particularly appropriate subject for research in multidisciplinary design and optimization (MDO). In fact, it is starkly clear that without the availability of powerful and versatile multidisciplinary design, analysis and optimization methods, the design, construction and operation of an HSCT simply cannot be achieved. The present research project is focused on the development and evaluation of MDO methods that, while broader and more general in scope, are particularly appropriate to the HSCT design problem. The research aims to not only develop the basic methods but also to apply them to relevant examples from the NASA HSCT R&D effort. The research involves a three year effort aimed first at the HSCT MDO problem description, next the development of the problem, and finally a solution to a significant portion of the problem.

Author

Supersonic Transports; Design Analysis; Optimization

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19990062665 NASA Glenn Research Center, Cleveland, OH USA

Pressure Balanced, Low Hysteresis, Finger Seal Test Results

Arora,Gul K., Allied-Signal Aerospace Co., USA; Proctor, Margaret P., NASA Glenn Research Center, USA; Steinetz, Bruce M., NASA Glenn Research Center, USA; DeLagado, Irebert R., Army Research Lab., USA; June, 1999; 16p; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics

Contract(s)/Grant(s): RTOP 538-12-99; DA Proj. 1L1-62211-A-47-A

Report No.(s): NASA/TM-1999-209191; NAS 1.15:209191; E-11705; ARL-MR-457; AIAA Paper 99-2686; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The finger seal is a revolutionary new technology in air to air sealing for secondary flow control and gas path sealing in gas turbine engines. Though the seal has been developed for gas turbines, it can be easily used in any machinery where a high pressure air cavity has to be sealed from a low pressure air cavity, for both static and rotating applications. This seal has demonstrated air leakage considerably less than a conventional labyrinth seal and costs considerably less than a brush seal. A low hysteresis finger seal design was successfully developed and tested in a seal rig at NASA Glenn Research Center. A total of thirteen configurations were tested to achieve the low hysteresis design. The best design is a pressure balanced finger seal with higher stiffness fingers. The low hysteresis seal design has undergone extensive rig testing to assess its hysteresis, leakage performance and life

capabilities. The hysteresis, performance and endurance test results are presented. Based on this extensive testing it is determined that the finger seal is ready for testing in an engine.
Author
Hysteresis; Labyrinth Seals; Technology Assessment; Turbine Engines; High Pressure; Fingers

19990062672 NASA Glenn Research Center, Cleveland, OH USA
The Numerical Propulsion System Simulation: A Multidisciplinary Design System for Aerospace Vehicles
Lytle, John K., NASA Glenn Research Center, USA; July 1999; 14p; In English; 14th; Air Breathing Engines, 5-10 Sep. 1999, Florence, Italy; Sponsored by International Society for Air Breathing Engines
Contract(s)/Grant(s): RTOP 509-10-11
Report No.(s): NASA/TM-1999-209194; NAS 1.15:209194; E-11708; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advances in computational technology and in physics-based modeling are making large scale, detailed simulations of complex systems possible within the design environment. For example, the integration of computing, communications, and aerodynamics has reduced the time required to analyze major propulsion system components from days and weeks to minutes and hours. This breakthrough has enabled the detailed simulation of major propulsion system components to become a routine part of design process and to provide the designer with critical information about the components early in the design process. This paper describes the development of the Numerical Propulsion System Simulation (NPSS), a multidisciplinary system of analysis tools that is focussed on extending the simulation capability from components to the full system. This will provide the product developer with a "virtual wind tunnel" that will reduce the number of hardware builds and tests required during the development of advanced aerospace propulsion systems.
Author
Aerospace Vehicles; Mathematical Models; Propulsion System Configurations; Simulation; Design Analysis

19990064011 NASA Dryden Flight Research Center, Edwards, CA USA
Flight Research Using F100 Engine P680063 in the NASA F-15 Airplane
Burcham, Frank W., Jr., NASA Dryden Flight Research Center, USA; Conners, Timothy R., NASA Dryden Flight Research Center, USA; Maxwell, Michael D., Pratt and Whitney Aircraft, USA; [1994]; 11p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The value of flight research in developing and evaluating gas turbine engines is high. NASA Dryden Flight Research Center has been conducting flight research on propulsion systems for many years. The F100 engine has been tested in the NASA F-15 research airplane in the last three decades. One engine in particular, S/N P680063, has been used for the entire program and has been flown in many pioneering propulsion flight research activities. Included are detailed flight-to-ground facility tests; tests of the first production digital engine control system, the first active stall margin control system, the first performance-seeking control system; and the first use of computer-controlled engine thrust for emergency flight control. The flight research has been supplemented with altitude facility tests at key times. This paper presents a review of the tests of engine P680063, the F-15 airplanes in which it flew, and the role of the flight test in maturing propulsion technology.
Author
Gas Turbine Engines; Evaluation; Fabrication; Propulsion System Performance; Production Management; In-Flight Monitoring; Ground Tests

19990064401 Alabama Univ., Huntsville, AL USA
Experimental Analysis of a Rocket Based Combined Cycle (RBCC) Engine in a Direct-Connect Test Facility
Nelson, K., Alabama Univ., USA; Hawk, Clark W., Alabama Univ., USA; 19970929; In English; 34th; Airbreathing Propulsion Subcommittee meetings, 21-31 Oct. 1997, West Palm Beach, FL, USA; Sponsored by Department of the Army; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The object of this study is to investigate the operation of a RBCC at ramjet and scramjet flight conditions using a direct-connect test facility. The apparatus being tested is a single strut-rocket within a dual-mode ram/scramjet combustor. The gaseous hydrogen/oxygen, linear strut-rocket was supplied by Aerojet Propulsion Company. The hardware is being tested in the Direct Connect Supersonic Combustion Test Facility at NASA Langley Research Center. The test facilities hydrogen/oxygen vitiated heater is capable of flight total enthalpies to Mach 8. A Mach 2.5 facility nozzle mates the heater to the combustor duct. The rocket ejector will ordinarily operate in a fuel-rich mode. Additional fuel injection is provided by a pair of parallel injectors located at the base of the strut body. Instrumentation on the test apparatus includes a unique, direct thrust measurement system. Performance predictions for the anticipated test conditions have been made using a one-dimensional, thermodynamic analysis

code. Results from the code show the dependence of overall thrust and specific impulse on rocket chamber pressure, rocket fuel equivalence ratio, and overall fuel equivalence ratio. Once the experimental test series begins, the inferred combustion efficiency as a function of axial location and the thermal choke region (where applicable) can also be determined using this code. Upon completion of the experimental test series, measurements will be used to calculate thrust, specific impulse, etc. Measured and calculated values will be compared to those found analytically. If appropriate, the code will be tailored to better predict hardware operation. Conclusions will be drawn as to the fuel-rich rocket's overall effect on ramjet and scramjet performance. Also, comparisons will be made between the integrated thrust calculated from the static pressure taps located along the duct and the thrust measured by the direct thrust measurement system.

Author

Experimentation; Rocket Thrust; Flight Characteristics; Combustion Efficiency; Cycles; Performance Prediction; Supersonic Combustion Ramjet Engines

19990064479 NASA Dryden Flight Research Center, Edwards, CA USA

Future Flight Test Plans of an Axisymmetric Hydrogen-Fueled Scramjet Engine on the Hypersonic Flying Laboratory

Roudakov, Alexander S., Central Inst. of Aviation Motors, Russia; Semenov, Vyacheslav L., Central Inst. of Aviation Motors, Russia; Kopchenov, Valeriy I., Central Inst. of Aviation Motors, Russia; Hicks, John W., NASA Dryden Flight Research Center, USA; 1996; 10p; In English; 7th; Spaceplanes and Hypersonics Systems and Technology, 18-22 Nov. 1996, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 96-4572; Copyright; Avail: Issuing Activity, Hardcopy

Under a contract with NASA, a joint Central Institute of Aviation Motors (CIAM) and NASA team is preparing to conduct the fourth flight test of a dual-mode scramjet aboard the CIAM Hypersonic Flying Laboratory, "Kholod." Ground-launch, rocket boosted by a modified Russian SA-5 missile, the redesigned scramjet is to be accelerated to a new maximum velocity of Mach 6.5. This should allow for the first-time measurement of the fully supersonic combustion mode. The primary program objective is the flight-to-ground correlation of measured data with preflight analysis and wind-tunnel tests in Russia and potentially in the USA. This paper describes the development and objectives of the program as well as the technical details of the scramjet and SA-5 redesign to achieve the Mach 6.5 aim test condition. The purpose and value of joint Russian-American program to attain overall hypersonic air-breathing technology objectives are discussed. Finally, the current project status and schedules to reach the final flight launch are discussed.

Author

Flight Tests; Planning; Supersonic Combustion Ramjet Engines; Airborne Equipment; Evaluation; Schedules

19990064547 NASA Lewis Research Center, Cleveland, OH USA

Damage Tolerance and Reliability of Turbine Engine Components

Chamis, Christos C., NASA Lewis Research Center, USA; 1998; 16p; In English; SC.78: Qualification of Life Extension Schemes for Engine Components, 5-9 Oct. 1998, Corfu, Greece; Copyright; Avail: Issuing Activity, Hardcopy

A formal method is described to quantify structural damage tolerance and reliability in the presence of multitude of uncertainties in turbine engine components. The method is based at the materials behavior level where primitive variables with their respective scatters are used to describe that behavior. Computational simulation is then used to propagate those uncertainties to the structural scale where damage tolerance and reliability are usually specified. Several sample cases are described to illustrate the effectiveness, versatility, and maturity of the method. Typical results from these methods demonstrate that the methods are mature and that they can be used for future strategic projections and planning to assure better, cheaper, faster products for competitive advantages in world markets. These results also indicate that the methods are suitable for predicting remaining life in aging or deteriorating structures.

Author

Tolerances (Mechanics); Damage; Reliability; Engine Parts

19990067263 Naval Air Warfare Center, Weapons Div., China Lake, CA USA

Large Engine Uncontained Debris Analysis *Final Report*

Frankenberger, C. E., III, Naval Air Warfare Center, USA; May 1999; 88p; In English

Contract(s)/Grant(s): DTFA03-95-X-90019

Report No.(s): AD-A364952; DOT/FAA/AR-99/11; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

Naval Air Warfare Center has conducted an analysis to define the characteristics of large commercial transport turbine engine uncontained debris. The objective of the analysis was to define the debris size, weight, exit velocity, and trajectory that can be used to update Advisory Circular (AC) 20-128A. The effort was conducted by gathering historical data from uncontained engine

failures. This data included, when available, phase of flight, engine operating condition, the failed engine component, aircraft damage location, and damage size. With this basic information, debris size was correlated to damage size. A methodology was developed to estimate debris exit velocity. Representative engine cases and cowls were defined and existing ballistic penetration equations used to calculate debris exit velocity. This analysis was conducted for disk and blade failures on fan, compressor, and turbine components. Results of the analysis provided some interesting insight to these events. Looking at the debris trajectories, the analysis shows that the trajectories defined in AC 20-128A are too narrow and should be expanded significantly. Also, the analysis highlights the fact that during an uncontained event the aircraft is subjected to multiple small fragment impacts, not just a single impact. It is the combined effects from the small fragments that pose the highest hazard potential to the aircraft.
DTIC

Debris; Damage Assessment; Turbine Engines; Aircraft Engines; Engine Failure; Engine Design

19990069225 NASA Plum Brook Reactor Facility, Sandusky, OH USA
Test Results of a Fixed Geometry RBCC Inlet
Goldman, A., Boeing Co., USA; Willis, B. P., NASA Plum Brook Reactor Facility, USA; May 13, 1999; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-2589; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Twelve cowl configurations were tested over the range 2.8 is less than M is less than 6.0 for a fixed geometry sidewall compression inlet for a Rocket Based Combined Cycle Engine (RBCC). Start and unstart were determined and air capture measured for each test condition. Inlet starting Mach number was at or below expected value. Placing a slot in the cowl allowed the inlet to start where a solid cowl configuration was unable to start. Mass capture for the no cowl configuration exceeded pre-test predictions whereas mass capture was less than pre-test predictions for the various cowl lengths tested.
Author

Cowlings; Mach Number; Wind Tunnel Tests; Supersonic Speed; Inlet Pressure; Inlet Nozzles; Pressure Distribution; Side Inlets; Hypersonic Inlets; Engine Inlets; Liquid Propellant Rocket Engines; Integral Rocket Ramjets

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19990062176 NASA Dryden Flight Research Center, Edwards,CA USA
Reconfigurable Flight Control Designs With Application to the X-33 Vehicle
Burken, John J., NASA Dryden Flight Research Center, USA; Lu, Ping, Iowa State Univ. of Science and Technology, USA; Wu, Zhenglu, Iowa State Univ. of Science and Technology, USA; August 1999; 20p; In English; Guidance Navigation and Control, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Contract(s)/Grant(s): RTOP 242-33-02-00-23
Report No.(s): NASA/TM-1999-206582; H-2345; NAS 1.15:206582; AIAA Paper 99-4134; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two methods for control system reconfiguration have been investigated. The first method is a robust servomechanism control approach (optimal tracking problem) that is a generalization of the classical proportional-plus-integral control to multiple input-multiple output systems. The second method is a control-allocation approach based on a quadratic programming formulation. A globally convergent fixed-point iteration algorithm has been developed to make onboard implementation of this method feasible. These methods have been applied to reconfigurable entry flight control design for the X-33 vehicle. Examples presented demonstrate simultaneous tracking of angle-of-attack and roll angle commands during failures of the right body flap actuator. Although simulations demonstrate success of the first method in most cases, the control-allocation method appears to provide uniformly better performance in all cases.
Author

Control Systems Design; MIMO (Control Systems); X-33 Reusable Launch Vehicle; Servomechanisms; Proportional Control; Flight Control; Launch Vehicle Configurations

19990062729 Maryland Univ., College Park, MD USA
Further Development, Support and Enhancement of CONDUIT *Final Report*
Veronica, Moldoveanu, Maryland Univ., USA; Levine, William S., Maryland Univ., USA; Jun. 14, 1999; 132p; In English
Contract(s)/Grant(s): NAG2-1122; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

From the first airplanes steered by handles, wheels, and pedals to today's advanced aircraft, there has been a century of revolutionary inventions, all of them contributing to flight quality. The stability and controllability of aircraft as they appear to a pilot are called flying or handling qualities. Many years after the first airplanes flew, flying qualities were identified and ranked from desirable to unsatisfactory. Later on engineers developed design methods to satisfy these practical criteria. CONDUIT, which stands for Control Designer's Unified Interface, is a modern software package that provides a methodology for optimization of flight control systems in order to improve the flying qualities. CONDUIT is dependent on an the optimization engine called CONSOL-OPTCAD (C-O). C-O performs multicriterion parametric optimization. C-O was successfully tested on a variety of control problems. The optimization-based computational system, C-O, requires a particular control system description as a MATLAB file and possesses the ability to modify the vector of design parameters in an attempt to satisfy performance objectives and constraints specified by the designer, in a C-type file. After the first optimization attempts on the UH-60A control system, an early interface system, named GIFCORCODE (Graphical Interface for CONSOL-OPTCAD for Rotorcraft Controller Design) was created.

Derived from text

Applications Programs (Computers); Controllability; Controllers; Design Analysis; Flight Control

19990063682 California Univ., Dept. of Mechanical and Aeronautical Engineering, Davis, CA USA

Accommodating Actuator Failures in Flight Control Systems *Final Report*

Hess, R. A., California Univ., USA; Siwakosit, W., California Univ., USA; Chung, J., California Univ., USA; [1998]; 49p; In English

Contract(s)/Grant(s): NCC1-266; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A technique for the design of flight control systems that can accommodate a set of actuator failures is presented. As employed herein, an actuator failure is defined as any change in the parametric model of the actuator which can adversely affect actuator performance. The technique is based upon the formulation of a fixed feedback topology which ensures at least stability in the presence of the failures in the set. The fixed compensation is obtained from a loop-shaping design procedure similar to Quantitative Feedback Theory and provides stability robustness in the presence of uncertainty in the vehicle dynamics caused by the failures. System adaptation to improve performance after actuator failure(s) occurs through a static gain adjustment in the compensator followed by modification of the system prefilter. Precise identification of the vehicle dynamics is unnecessary. Application to a single-input, single-output design using a simplified model of the longitudinal dynamics of the NASA High Angle of Attack Research Vehicle is discussed. Non-real time simulations of the system including a model of the pilot demonstrate the effectiveness and limitations of the approach.

Author

Actuators; Failure; Flight Control; Control Systems Design; Procedures; SISO (Control Systems)

19990064010 NASA Dryden Flight Research Center, Edwards, CA USA

An Overview of Controls and Flying Qualities Technology on the F/A-18 High Alpha Research Vehicle

Pahle, Joseph W., NASA Dryden Flight Research Center, USA; Wichman, Keith D., NASA Dryden Flight Research Center, USA; Foster, John V., NASA Langley Research Center, USA; Bundick, W. Thomas, NASA Langley Research Center, USA; [1996]; 27p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NASA F/A-18 High Alpha Research Vehicle (HARV) has been the flight test bed of a focused technology effort to significantly increase maneuvering capability at high angles of attack. Development and flight test of control law design methodologies, handling qualities metrics, performance guidelines, and flight evaluation maneuvers are described. The HARV has been modified to include two research control effectors, thrust vectoring, and actuated forebody strakes in order to provide increased control power at high angles of attack. A research flight control system has been used to provide a flexible, easily modified capability for high-angle-of-attack research controls. Different control law design techniques have been implemented and flight-tested, including eigenstructure assignment, variable gain output feedback, pseudo controls, and model-following. Extensive piloted simulation has been used to develop nonlinear performance guide-lines and handling qualities criteria for high angles of attack. This paper reviews the development and evaluation of technologies useful for high-angle-of-attack control. Design, development, and flight test of the research flight control system, control laws, flying qualities specifications, and flight test maneuvers are described. Flight test results are used to illustrate some of the lessons learned during flight test and handling qualities evaluations.

Author

Control Theory; Control Equipment; Thrust Vector Control; Research Vehicles; Maneuvers; Flight Tests; Flight Control

19990064144 Auburn Univ., Aerospace Engineering, AL USA

Rotationally Adaptive Flight Test Surface

Barrett, Ron, Auburn Univ., USA; Apr. 15, 1999; 38p; In English

Contract(s)/Grant(s): NCC4-103; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Research on a new design of flutter exciter vane using adaptive materials was conducted. This novel design is based on all-moving aerodynamic surface technology and consists of a structurally stiff main spar, a series of piezoelectric actuator elements and an aerodynamic shell which is pivoted around the main spar. The work was built upon the current missile-type all-moving surface designs and change them so they are better suited for flutter excitation through the transonic flight regime. The first portion of research will be centered on aerodynamic and structural modeling of the system. USAF DatCom and vortex lattice codes was used to capture the fundamental aerodynamics of the vane. Finite element codes and laminated plate theory and virtual work analyses will be used to structurally model the aerodynamic vane and wing tip. Following the basic modeling, a flutter test vane was designed. Each component within the structure was designed to meet the design loads. After the design loads are met, then the deflections will be maximized and the internal structure will be laid out. In addition to the structure, a basic electrical control network will be designed which will be capable of driving a scaled exciter vane. The third and final stage of main investigation involved the fabrication of a 1/4 scale vane. This scaled vane was used to verify kinematics and structural mechanics theories on all-moving actuation. Following assembly, a series of bench tests was conducted to determine frequency response, electrical characteristics, mechanical and kinematic properties. Test results indicate peak-to-peak deflections of 1.1 deg with a corner frequency of just over 130 Hz.

Author

Flight Tests; Vanes; Aerodynamic Configurations; Control Surfaces; Flight Control; Adaptive Control; Flutter Analysis; Aeroservoelasticity; Dynamic Structural Analysis

19990064385 Dayton Univ. Research Inst., Structural Integrity Div., OH USA

Evaluation of Methods to Separate Maneuver and Gust Load Factors from Measured Acceleration Time Histories *Final Report*

Rustenburg, J. W.; Skinn, D.; Tipps, D. O.; Apr. 1999; 44p; In English

Contract(s)/Grant(s): 437-25-14

Report No.(s): PB99-150070; UDR-TM-1998-00011; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The University of Dayton is supporting Federal Aviation Administration (FAA) research on the structural integrity requirements for the US commercial transport airplane fleet. The primary objective of this research is to support the FAA Airborne Data Monitoring Systems program by developing new and improved methods and criteria for processing and presenting large commercial transport airplane flight and ground loads usage data. The accelerations recorded in flight result from maneuver inputs initiated by the pilot and atmospheric turbulence. to determine the gust and maneuver load factor spectra from the recorded flight loads data, it is necessary to separate the gust and maneuver load factors. Various means to separate the accelerations due to pilot maneuvers and turbulence from measured acceleration time histories have been used. This report presents the results of a study to evaluate the validity and operational processing efficiency of three different methods for the separation of maneuvers and gusts from measured acceleration data obtained from Optical Quick Access Recorder (OQAR)-equipped commercial aircraft. Conclusions and recommendations for the use of a maneuver-gust separation method are also provided.

NTIS

Gust Loads; Data Systems; Acceleration (Physics); Aircraft Maneuvers; Data Acquisition

19990064521 NASA Langley Research Center, Hampton, VA USA

Computational Investigation of Fluidic Counterflow Thrust Vectoring

Hunter, Craig A., NASA Langley Research Center, USA; Deere, Karen A., NASA Langley Research Center, USA; 1999; In English; 35th; Joint Propulsion, 20-23 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-2669; Copyright; Avail: Issuing Activity, Hardcopy

A computational study of fluidic counterflow thrust vectoring has been conducted. Two-dimensional numerical simulations were run using the computational fluid dynamics code PAB3D with two-equation turbulence closure and linear Reynolds stress modeling. For validation, computational results were compared to experimental data obtained at the NASA Langley Jet Exit Test Facility. In general, computational results were in good agreement with experimental performance data, indicating that efficient thrust vectoring can be obtained with low secondary flow requirements (less than 1% of the primary flow). An examination of the computational flowfield has revealed new details about the generation of a countercurrent shear layer, its relation to secondary suction, and its role in thrust vectoring. In addition to providing new information about the physics of counterflow thrust vectoring,

this work appears to be the first documented attempt to simulate the counterflow thrust vectoring problem using computational fluid dynamics.
Author
Computational Fluid Dynamics; Counterflow; Fluidics; Turbulent Flow; Turbulence Models; Reynolds Stress; Reynolds Averaging; Navier-Stokes Equation; Secondary Flow

19990069616 California Univ., Dept. of Materials Science and Mineral Engineering, Berkeley, CA USA
Micromechanical Flying Insect (MFI), Year 1 Report May 1998 - May 1999, *May 1998 - May 1999*
Fearing, R. S.; Pister, K. S.; Sastry, S. S.; Dickinson, M. H.; Liepmann, D.; May 1999; 22p; In English
Contract(s)/Grant(s): N00014-98-1-0671
Report No.(s): AD-A364781; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We propose to develop a micromechanical flying insect (MFI), a 10-25 mm (wingtip-to-wingtip) device eventually capable of sustained autonomous flight. The goal of the MFI project is to use biomimetic principles to capture some of the exceptional flight performance achieved by true flies. The project is divided into four stages: 1) feasibility analysis, 2) structural fabrication, 3) aerodynamics and wing control, and 4) flight control and integration. Our design analysis shows us that piezoelectric actuators and flexible thorax structures can provide the needed power density and wing stroke, and adequate power can be supplied by solar cells. In the first year of this MURI grant, research has been concentrated in understanding fly flight aerodynamics and in analysis, design and fabrication of MFI structures.
DTIC
Micromechanics; Design Analysis; Aerodynamics; Fabrication; Insects

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19990063446 Oklahoma Baptist Univ., Dept. of Physics, Shawnee, OK USA
A Study of Mars Dust Environment Simulation at NASA Johnson Space Center Energy Systems Test Area Resource Conversion Test Facility *Final Report*
Chen, Yuan-Liang Albert, Oklahoma Baptist Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1998; May 1999; Volume 1, pp. 5-1 - 5-12; In English; See also 19990063441
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The dust environment on Mars is planned to be simulated in a 20 foot thermal-vacuum chamber at the Johnson Space Center, Energy Systems Test Area Resource Conversion Test Facility in Houston, Texas. This vacuum chamber will be used to perform tests and study the interactions between the dust in Martian air and ISPP hardware. This project is to research, theorize, quantify, and document the Mars dust/wind environment needed for the 20 foot simulation chamber. This simulation work is to support the safety, endurance, and cost reduction of the hardware for the future missions. The Martian dust environment conditions is discussed. Two issues of Martian dust, (1) Dust Contamination related hazards, and (2) Dust Charging caused electrical hazards, are of our interest. The different methods of dust particles measurement are given. The design trade off and feasibility were studied. A glass bell jar system is used to evaluate various concepts for the Mars dust/wind environment simulation. It was observed that the external dust source injection is the best method to introduce the dust into the simulation system. The dust concentration of 30 Mg/M3 should be employed for preparing for the worst possible Martian atmosphere condition in the future. Two approaches thermal-panel shroud for the hardware conditioning are discussed. It is suggested the wind tunnel approach be used to study the dust charging characteristics then to be apply to the close-system cyclone approach. For the operation cost reduction purpose, a dehumidified ambient air could be used to replace the expensive CO2 mixture for some tests.
Author
Dust; Mars Atmosphere; Test Facilities; Vacuum Chambers; Mars Environment; Environment Simulation

19990063739 NASA Glenn Research Center, Cleveland, OH USA
New Icing Cloud Simulation System at the NASA Glenn Research Center Icing Research Tunnel
Irvine, Thomas B., NASA Glenn Research Center, USA; Oldenburg, John R., NASA Glenn Research Center, USA; Sheldon, David W., NASA Glenn Research Center, USA; June 1999; 24p; In English; 36th; Aerospace Sciences, 12-15 Jan. 1998, Reno,

NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics
Contract(s)/Grant(s): RTOP 523-91-13
Report No.(s): NASA/TM-1999-208891; NAS 1.15:208891; AIAA Paper 98-0143; E-11477; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new spray bar system was designed, fabricated, and installed in the NASA Glenn Research Center's Icing Research Tunnel (IRT). This system is key to the IRT's ability to do aircraft in-flight icing cloud simulation. The performance goals and requirements levied on the design of the new spray bar system included increased size of the uniform icing cloud in the IRT test section, faster system response time, and increased coverage of icing conditions as defined in Appendix C of the Federal Aviation Regulation (FAR), Part 25 and Part 29. Through significant changes to the mechanical and electrical designs of the previous-generation spray bar system, the performance goals and requirements were realized. Postinstallation aerodynamic and icing cloud calibrations were performed to quantify the changes and improvements made to the IRT test section flow quality and icing cloud characteristics. The new and improved capability to simulate aircraft encounters with in-flight icing clouds ensures that the IRT will continue to provide a satisfactory icing ground-test simulation method to the aeronautics community.
Author
Ice Formation; In-Flight Simulation; Ground Tests; Aircraft Icing; Calibrating

19990063760 NASA Marshall Space Flight Center, Huntsville, AL USA
Expanding Capabilities: Trisonic to Hypersonic
Springer, Anthony M., NASA Marshall Space Flight Center, USA; 1999; 5p; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy

The NASA Marshall Space Flight Center recently undertook a study to determine the feasibility of expanding she operation capabilities of it's 14-inch trisonic wind tunnel to Mach 6 or hypersonic speeds. Currently the wind tunnel has an operational range of Mach 0.2 to 5.0. The first part of the study involved the determination of flow requirements using compressible involved theory and equations The second part involved the determination of the operating constraints at Mach 6 using current equipment and the operational requirements imposed by the expanded Mach range. It was determined from this study that it should be theoretically possible to obtain Mach 6 with the current equipment. However Mach 6 does pose operational problems for the facility. to validate Mach 6 capabilities, a calibration of the wind tunnel is required to determine if experimental flow conditions are present for experimental testing and to determine the operational parameters at Mach 6.
Author
Trisonic Wind Tunnels; Hypersonic Speed; Calibrating; Mach Number; Equipment Specifications

19990063870 Institute for Human Factors TNO, Soesterberg, Netherlands
Low-Cost Simulators 3b: Minimal Functional Requirements for a Driver Training Simulator *Interim Report Low-cost Simulatoren 3b: Minimale Functionele Eisen voorRijsimulatoren*
Kappe, B., Institute for Human Factors TNO, Netherlands; Korteling, J. E., Institute for Human Factors TNO, Netherlands; Oct. 16, 1998; In English
Contract(s)/Grant(s): TNO Proj. 730.3; A96/CO/957
Report No.(s): TD98-0269; TM-98-A058; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy

To investigate the possibilities for application of low-cost simulators within military training courses, the research project called ELSTAR (European Low-cost Simulation Technology for the Armed forces) is carried out under contract of the Ministries of Defence of the five participating countries of Research Technology Project (RTP) 1.1.8, viz. Belgium, France, Germany, Greece, and The Netherlands. In the first work package (Analysis of military training), four training areas were selected for further research, i.e. driver training, UAV crew training, infrared and image intensifier operation training, and mission management training. This selection was based on expert-scores on the ELSTAR taxonomy, the results of global task-, training-, and cost-utility analysis, and expert judgements on the generic value and complementarity of the knowledge that would be acquired. One of the basic premises of the ELSTAR approach for developing low-cost training systems is to identify and select those critical task elements that can be simulated at low cost with high fidelity and training value. Therefore, in work package 3 (Simulator requirements) of the ELSTAR project, an elaborate investigation of the task- and training requirements and the functional specifications of the selected training system. In ELSTAR Wp 3b, 17 so-called 'elementary driving tasks' have been identified (Van Winsum & Korteling, 1998). Elementary driving tasks are defined such that they are relatively independent of each other. This relative independency allows the construction of (complex) higher-order subtasks just by combining these elementary tasks. The present report describes the derivation of the functional simulator requirements to train each elementary driving task. This

is done for six most relevant functional simulator specifications, i.e. display resolution, field of view, complexity of the environment, etc. For each elementary driving task the line of thought and the data leading to the definition of a functional specification is described. Since not all relevant data is available in the literature, this process inherently involves the use of 'rules of thumb' and 'educated guesses'. Since the process is transparent, new relevant data can be introduced readily at the appropriate elementary driving tasks The result of the process is a matrix of elementary driving tasks and functional specifications that allows an elementary driving task to be related to specific simulator specifications. by relating these functional specifications to hardware components, it becomes possible to easily explore the costs of various simulator configurations. Combined with an analysis of the cost of conventional training, cost effective low-cost driving simulators concepts may be developed. The present report describes the minimal functional requirements (costs) per elementary driving task., whereas the relationship between elementary driving tasks at one hand and training needs and -investments (savings) at the other, and the development of one or several low-cost simulator concepts for driver training will be subsequently reported.

Author

Training Simulators; Systems Simulation; Education; Infrared Imagery; Cost Analysis; Functional Design Specifications

19990063908 General Accounting Office, Washington, DC USA

Airport Financing: Information on Airport Fees Paid by Airlines

Nov. 1998; 24p; In English

Report No.(s): PB99-156572; GAO/RCED-99-26R; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Airports charge airlines to use runways and other facilities, and disputs over fees sometimes arise. In 1994, after a higly publicized dispute between Los Angeles International Airport and the airlines operating there, the Congress passed legislation establishing expedited procedures at the Department of Transportation (DOT) for handling fee disputes between airports and airlines. As requested, this report (1) describes how these fees are set, (2) explains DOT's role in resolving disputes between airports over these fees, and (3) discusses the formal disputes that have arisen over airport fees in the past 14 years.

NTIS

Airline Operations; Airports; Law (Jurisprudence)

19990063939 General Electric Co., Schenectady, NY USA

Building a simulator control station using the TCL/TK language

LaBelle, D. R.; Apr. 30, 1998; 7p; In English; 1998 advanced simulation technologies

Report No.(s): DE99-001963; KAPL-P-000203; K-97157; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes the construction of a simulator graphical user interface (GUI) using the cross-platform, public domain programming language TCL/TK. TCL/TK is a high level scripting language for building GUIs. It is freely available for UNIX, Windows and the Mac operating systems. This paper will demonstrate how the traditionally difficult, time consuming aspects of producing a simulator control station are easily overcome with TCL/TK. Referred to as the Interactive Control Station (ICS), this user interface provides a graphical method for interactive control of real time applications produced with the Real Time Programming Environment (RTProE). The techniques and tools developed for connecting the ICS to real time simulator models are described in detail within the paper. The real time data collection and plotting tool included with the ICS is also discussed. The ICS uses a client/server design and can provide its features across a distributed computer network. Standard TCP/IP sockets are used as the communications transport medium. Multiple clients on a network may be served by a single server connected to the simulation. The clients may exist on the same or separate computers. Multiple servers, connected to different simulations, can also exist on the same or separate computers of the network.

NTIS

Computer Networks; Simulators; Graphical User Interface; Interactive Control

19990064498 Florida Agricultural and Mechanical Univ., Tallahassee, FL USA

Development of Tools and Support for Measurements in the NASA 80x120 Foot Wind Tunnel

Lourenco, L., Florida Agricultural and Mechanical Univ., USA; [1999]; 7p; In English

Contract(s)/Grant(s): NAG2-1183; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report describes the first study leading to the application of Particle Image Velocimetry to diagnose rotor type flows in the NASA Ames 80x120-foot wind tunnel facility. The necessary steps towards the implementation of PIV to study rotor type

flows were first investigated in the Army Rotor Hover Chamber. The model problem consisted of the three-dimensional flow generated by a two-blade rotor at different wake ages.
Author
Wind Tunnels; Particle Image Velocimetry; Flow Measurement

19990068494 Marine Corps, Washington, DC USA
Refresher Physiology in Aircraft Simulators (SIMPHYS)
Mason, R. P., Marine Corps, USA; Aeromedical Aspects of Aircrew Training; June 1999, pp. 18-1 - 18-2; In English; See also 19990068480; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

The use of aircraft simulation in aviation training programs has increased significantly in recent years along with their capabilities and sophistication. Aircrew coordination training (ACT), aircraft systems checks, instrument rating checks, and emergency procedures training are currently being conducted in flight simulators. As flight simulator use and fidelity increases, the ability to replicate actual flight conditions and aeromedical safety issues are both enhanced. A simulator-based curriculum was developed by modifying the learning objectives from the existing rotary wing refresher aviation physiology and survival training curriculum to performance based objectives that could be demonstrated in a simulator-based curriculum. The AH-1W (Super Cobra) Weapons Systems Trainer (Device 2F136) at MCAS Camp Pendleton, CA was used as the simulator test bed. Fourteen pilots completed the prototype curriculum and were questioned on its efficacy. All fourteen pilots identified the simulator-based curriculum as superior to the existing curriculum and as more effective in meeting the curriculum's learning objectives. Substantial increases across all learning domains were demonstrated and a change in the pilots' attitudes towards refresher physiology training was noted. A simulator-based rotary wing refresher aviation physiology and survival training curriculum is feasible and should be adopted to provide effective aeromedical training for aircrew. Further evaluation is on going to determine the potential and effectiveness of a fast jet and transport simulator-based curricula.
Author
Flight Simulators; Education; Flight Crews; Aerospace Medicine; Computerized Simulation

19990069617 Little (Arthur D.), Inc., Cambridge, MA USA
Modular Aircraft Support System (MASS) Concept Validation
Hablanian, David A.; Dec. 1998; 87p; In English
Report No.(s): AD-A364771; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Modular Aircraft Support System (MASS) program is part of a research effort to improve the reliability, maintainability, operability, and deployability of aerospace ground equipment (AGE.) The purpose of Delivery Order 0003 was to perform further requirements gathering, conceptual design, and analysis of the six system concepts which were developed in Delivery Order 0002. The results of the analysis were used to perform a downselect to a single system that provides the most promise for the eventual MASS proof-of-concept unit. The single downselected concept incorporates elements of several of the initial six concepts. The key elelements of the new concept are: (1) diesel prime mover; (2) electrical power distribution between modules; (3) two or three carts; and, (4) no more than four distinct modules per cart. Layoutdrawings and detailed life-cycle costs projections were developed for the MASS modules, chassis and carts.
DTIC
Support Systems; Modules; Ground Support Equipment

19990070304 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan
Performance Characteristics of a Free-Piston Shock Tube
Kihara, Hisashi, Kyushu Univ., Japan; Okinaka, Kazumi, Kyushu Univ., Japan; Aso, Shigeru, Kyushu Univ., Japan; Nishida, Michio, Kyushu Univ., Japan; Park, Jong-ho, Chungnam National Univ., Korea, Republic of; Memoirs of the Faculty of Engineering, Kyushu University; June 1995; ISSN 0023-6160; Volume 55, No. 2, pp. 183-191; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper describes the performance test of a free-piston shock tube built in Department of Aeronautics and Astronautics, Kyushu University and some results of the performance test are shown. This shock tube was built for the purpose of investigating high temperature effect in shock heated gas. In this type of shock tube, the performance of a facility partly depends on the characteristics of a compression tube, so that, the characteristics of the compression tube were calculated and compared with the experiments. The comparison shows good agreement between the experiment and calculation concerning the compression

process of the compression tube. It has been confirmed that the facility can produce shock Mach numbers of 11 to 24 for the initial test section pressures of 65.5 Pa to 1.33 kPa in nitrogen and air.

Author

Shock Tubes; Performance Tests; Shock Waves; Shock Heating; Hypersonic Flow; Magnetic Pistons

10
ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; space communications; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

19990066628 NASA Ames Research Center, Moffett Field, CA USA

Aerothermodynamic Heating Analysis of Aerobraking and Aeromaneuvering Orbital Transfer Vehicles

Menees, Gene P., NASA Ames Research Center, USA; Davies, Carol B., Informatics General Corp., USA; Wilson, John F., Informatics General Corp., USA; Brown, Kevin G., NASA Ames Research Center, USA; Progress in Astronautics and Aeronautics: Thermal Design of Aeroassisted Orbital Transfer Vehicles; 1985; Volume 96, pp. 338-360; In English; 19th; Thermophysics, 25-28 Jun. 1984, Snowmass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 84-1711; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The thermal-protection requirements of two aeroassisted orbital transfer vehicles (AOTVS) are analyzed for return missions between the geosynchronous and Shuttle orbits. One of the designs is a specialized version of a previously proposed generic aerobraking vehicle that is capable of only delivery-type operations. The other is a high-lift aeromaneuvering vehicle that is optimized for low Earth orbit sortie missions involving large, multiple plane-inclination changes. The aerothermal environment of the aerobraking vehicle is analyzed using state-of-the-art methods for nonequilibrium-radiative and convective heating that incorporate refinements unique to the configuration. The heating analysis of the aeromaneuvering vehicle required the development of a flowfield model for rarefied-hypersonic flow over a lifting surface at incidence. The predicted aerothermodynamic heating characteristics for both vehicles are correlated with thermal-control

Author

Aerothermodynamics; Heating; Aerobraking; Orbit Transfer Vehicles; Thermal Protection; Design Analysis; Models; Convective Heat Transfer; Aeromaneuvering; Rarefied Gas Dynamics

19990064192 Computer Sciences Corp., Lanham, MD USA

Review of Spinning Spacecraft Dynamics Analyses and Inflight Experience

Ottenstein, Neil A., Computer Sciences Corp., USA; 1999 Flight Mechanics Symposium; May 1999, pp. 433-447; In English; See also 19990064158

Contract(s)/Grant(s): GS-35F-4381G; NASA Order S-24280-G; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This paper presents investigations of attitude drift model results and bias trends for the Global Geospace Science (GGS) Interplanetary Physics Laboratory (WIND) and the Polar Plasma Laboratory (POLAR) as well as a study of Sun-only attitude determination for POLAR.

Author

Spacecraft Stability; Satellite Attitude Control; Flight Characteristics; Solar Sensors; Orbit Perturbation

19990069975 Draper (Charles Stark) Lab., Inc., Cambridge, MA USA

Autonomous Intact Abort System for the X-34

Tragesser, Steven G., Draper (Charles Stark) Lab., Inc., USA; Barton, Gregg H., Draper (Charles Stark) Lab., Inc., USA; 1999; 10p; In English; Atmospheric Flight Mechanics, 9-11 Aug. 1999, Portland, OR, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-4253; No Copyright; Avail: Issuing Activity, Hardcopy

Autonomous algorithms are developed which provide trajectory guidance for horizontally landing vehicles such as the X-34 under a variety of abort conditions. The nominal guidance system of the X-34 is incapable of directing the vehicle to a safe landing for many possible situations in which trajectory is far away from nominal conditions (as in the case of an engine failure). To minimize the risk of losing the vehicle, the autonomous intact abort system considers multiple landing sites and redesigns certain guidance inputs in order to adapt to the new conditions presented by the abort. The abort system design is demonstrated in a high-fidelity simulation to prove the feasibility of the concept for various engine-out These abort algorithms are being

incorporated into the X-34 vehicle to flight test this new technology as a part of the Future X Pathfinder Flight Demonstration Program.
Author
Autonomy; X-34 Reusable Launch Vehicle; Abort Apparatus; Systems Engineering; Design Analysis; Aircraft Design

19990062670 NASA Glenn Research Center, Cleveland, OH USA
Performance of the MIR Cooperative Solar Array After 2.5 Years in Orbit
Kerslake, Thomas W., NASA Glenn Research Center, USA; Hoffman, David J., NASA Glenn Research Center, USA; July 1999; 8p; In English; 34th; Intersociety Energy Conversion Engineering, 1-5 Aug. 1999, Vancouver, British Columbia, Canada; Sponsored by Society of Automotive Engineers
Contract(s)/Grant(s): NAS15-10110; RTOP 478-12-10
Report No.(s): NASA/TM-1999-209287; NAS 1.15:209287; E-11757; SAE-99-01-2632; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Mir Cooperative Solar Array (MCSA) was developed jointly by the USA and Russia to produce 6 kW of power for the Russian space station Mir. Four, multi-orbit test sequences were executed between June 1996 and December 1998 to measure MCSA electrical performance. A dedicated FORTRAN computer code was developed to analyze the detailed thermal-electrical performance of the MCSA. The computational performance results compared very favorably with the measured flight data in most cases. Minor performance degradation was detected in one current generating section of the MCSA. Yet overall, the flight data indicated the MCSA was meeting and exceeding performance expectations. There was no precipitous performance loss due to contamination or other causes after 2.5 years of operation. In this paper, we review the MCSA flight electrical performance tests, data and computational modeling and discuss findings from data comparisons with the computational results.
Author
Solar Arrays; Temperature Effects; Performance Tests; Flight Characteristics; Electrical Properties

19990063362 Research Inst. of National Defence, Weapons and Protection Div., Tumba, Sweden
Initial Studies of the Pulse Detonation Engine *Topical Report*
Tegner, J. K.; Jun. 1998; 30p; In English
Report No.(s): PB99-150831; FOA-R-98-00795-310-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this report, it is verified that the Pulse Detonation Engine - the PDE - indeed has to potential of reaching a high specific impulse under the assumption that two key issues can be resolved - the initiation of the detonation and the problems involved in reaching the high frequency necessary in order to gain acceptable performance levels. The results presented neglect both of these difficulties by employing high energy levels in order to initiate the detonation and by only consider a single pulse. Estimates of the specific impulse, the thrust, the frequency by which the detonations can be repeated and the maximum pressure in the engine is obtained for different fuels as well as different strategies for the initiation, e.g. the mixture initiated either at the closed or at the open end of the tube. Good agreement between the results obtained by numerical calculations in two dimensions - with detailed kinetics - and the experimental data is obtained. The results seem to indicate that the difference in performance between the initiation at the closed and at the open end is small, and that initiation at the closed end is more reliable than initiation at the open end (for the levels of energy considered in these experiments).
NTIS
Detonation; Detonation Waves; Rocket Engines; Propellant Explosions; Ignition Systems; Firing (Igniting); Pulsejet Engines; Detonable Gas Mixtures; Gaseous Fuels

19990063364 Research Inst. of National Defence, Weapons and Protection Div., Tumba, Sweden
Pulse Detonation Engine: A Survey of the Literature
Tegner, J. K.; Jun. 1998; 30p; In English
Report No.(s): PB99-150815; FOA-R-98-00793-310-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report briefly explains the principal behind the pulse detonation wave engine (PDWE) and presents a study of the literature about computational and experimental aspects concerning this engine type. A large number of numerical studies have been performed whereas only a few experiments have been put together.
NTIS
Detonation Waves; Combustible Flow; Detonation; Propellant Explosions; Rocket Firing; Pulsejet Engines; Firing (Igniting); Rocket Engines

19990063723 GenCorp Aerojet, Azusa, CA USA

Testing of the Strutjet RBCC Engine

Bulman, Mel; GenCorp Aerojet, USA; Neill, Todd; GenCorp Aerojet, USA; Yam, Clement; GenCorp Aerojet, USA; 1999; In English; 35th; Joint Propulsion, 20-23 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS8-48891

Report No.(s): AIAA Paper 99; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The testing of the Strutjet Rocket-Based Combined Cycle (RBCC) engine is described in this presentation. Since 1996 Aerojet has conducted thousands of tests on its Strutjet RBCC Engine. The Strutjet is specifically designed as an RBCC engine. The tests included: (1) Inlet, (2) Rocket Checkouts, (3) Direct Connect Mach 6 and 8, and (4) Freejet M = 0, 2.4, 4.1. The modes tested include: (1) Air Augmented Rocket (AAR), (2) Ramjet (3) Scramjet (4) Scram/Rocket (5) Ascent/Rocket. The Strutjet RBCC engine has been tested across the complete airbreathing trajectory. The presentation shows the results of the tests, through diagrams, charts and pictures.

CASI

Air Breathing Engines; Ramjet Engines; Rocket Engines; Supersonic Combustion Ramjet Engines; Checkout; Engine Tests; Rocket Engine Design; Hypersonic Speed

19990063761 GenCorp Aerojet, Sacramento, CA USA

Design of a Novel Gaseous Hydrogen-Oxygen Rocket Injector Element

Glenn, Dennis E.; GenCorp Aerojet, USA; 1999; 2p; In English; Fluent Users' Group Meeting, 26 May 1999, Danvers, MA, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS8-40891; Copyright; Avail: Issuing Activity, Hardcopy

NASA and Aerojet are developing a Rocket-Based Combined Cycle (RBCC) engine under the Advanced Reusable Technology program. The rocket application requires that the combustion process be stable, complete, and take place in as short a distance as possible without compromising the structural integrity of the injector itself. A novel gaseous hydrogen-oxygen rocket injector element design was arrived at through an iterative design process making extensive use of CFD simulations, which resulted in a design that is meeting design goals. Sub-scale versions of the injector have been built and tested in a unique test-rig and in a sub-scale RBCC engine. The Aerojet RBCC concept integrates small rocket thrusters into the rearfacing base area of struts placed in the flowpath of a scramjet (Supersonic Combusting Ramjet) engine. In one mode of operation, at vehicle takeoff, the rockets provide the primary thrust with additional thrust coming from an ejector effect as air is drawn into the engine inlet, entrained, and accelerated by the rocket exhaust.

Derived from text

Supersonic Combustion Ramjet Engines; Reaction Kinetics; Injectors; Engine Inlets; Computational Fluid Dynamics; Rocket Exhaust

19990064486 NASA Marshall Space Flight Center, Huntsville, AL USA

Rocket-Based Combined Cycle Activities in the Advanced Space Transportation Program Office

Hueter, Uwe, Core Technologies; Turner, James, DRACO; Jun. 01, 1999; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics

Report No.(s): AIAA Paper 99-2352; Copyright; Avail: Issuing Activity, Hardcopy

NASA's Office of Aero-Space Technology (OAST) has established three major goals, referred to as, "The Three Pillars for Success". The Advanced Space Transportation Program Office (ASTP) at the NASA's Marshall Space Flight Center (MSFC) in Huntsville, Ala. focuses on future space transportation technologies Under the "Access to Space" pillar. The Core Technologies Project, part of ASTP, focuses on the reusable technologies beyond those being pursued by X-33. One of the main activities over the past two and a half years has been on advancing the rocket-based combined cycle (RBCC) technologies. In June of last year, activities for reusable launch vehicle (RLV) airframe and propulsion technologies were initiated. These activities focus primarily on those technologies that support the decision to determine the path this country will take for Space Shuttle and RLV. This year, additional technology efforts in the reusable technologies will be awarded. The RBCC effort that was completed early this year was the initial step leading to flight demonstrations of the technology for space launch vehicle propulsion.

Author

X-33 Reusable Launch Vehicle; Space Transportation; Propulsion; Airframes

19990064624 NASA Marshall Space Flight Center, Huntsville, AL USA

Demonstrating the Performance Benefits of the Strutjet RBCC for Space Launch Architectures

Siebenhaar, Adam, GenCorp Aerojet, USA; Bulman, Mel, GenCorp Aerojet, USA; Johnson, Richard, GenCorp Aerojet, USA; Fazah, Mike, NASA Marshall Space Flight Center, USA; May 12, 1999; In English; 14th; International Symposium on Airbreathing Engines (ISABE), 5-10 Sep. 1999, Florence, Italy

Contract(s)/Grant(s): RTOP 242-72-01; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Rocket Based Combined Cycle (RBCC) engine synergistically combines the best elements of airbreathing and rocket propulsion to benefit a wide range of future reusable launch vehicles (RLV). Aerojet's Strutjet RBCC offers high Isp during mid-phase acceleration, and high thrust for boost and final ascent phases. The result is a relatively low gross weight vehicle that reduces thrust requirements compared with all-rocket solutions. Relative to combination propulsion systems, the integrated propulsive elements of the Strutjet reduce engine weight and complexity. This paper will summarize the results of tests demonstrating our latest hydrogen-fueled Strutjet RBCC engine performance, including inlet operability and performance over a range of conditions, sea level static and Mach 2.4 rocket thrust augmentation, ramjet and scramjet performance, combined scramjet/rocket performance at Mach 8, and ascent mode rocket performance. These tests have significantly advanced the technology readiness of the Strutjet engine and substantiate the performance benefits of RBCC engines for reusable launch vehicle applications. A companion paper provides a focus on Strutjet as a basis for advanced air and space architecture, covering hydrogen and hydrocarbon fuels and cooled structures.

Author

Ramjet Engines; Turbojet Engines; Rocket Engines; Reusable Launch Vehicles; Spacecraft Launching; Propulsion System Configurations; Propulsion System Performance

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19990062338 NASA Lewis Research Center, Cleveland, OH USA

SiC and Si3N4 Recession Due to SiO2 Scale Volatility Under Combustor Conditions

Smialek, James L., NASA Lewis Research Center, USA; Robinson, R. Craig, NASA Lewis Research Center, USA; Opila, Elizabeth J., NASA Lewis Research Center, USA; Fox, Dennis S., NASA Lewis Research Center, USA; Jacobson, Nathan S., NASA Lewis Research Center, USA; Advanced Composite Materials; 1999; Volume 8, No. 1, pp. 33-45; In English; Processing and Testing on CMC Parts, Components and Pieces, 11-12 Sep. 1998, Tajimi, Japan; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

SiC and Si3N4 materials were tested under various turbine engine combustion environments, chosen to represent either conventional fuel-lean or fuel-rich mixtures proposed for high speed aircraft. Representative CVD, sintered, and composite materials were evaluated in both furnace and high pressure burner rig exposure. While protective SiO2 scales form in all cases, evidence is presented to support paralinear growth kinetics, i.e. parabolic growth moderated simultaneously by linear volatilization. The volatility rate is dependent on temperature, moisture content, system pressure, and gas velocity. The burner tests were used to map SiO2 volatility (and SiC recession) over a range of temperature, pressure, and velocity. The functional dependency of material recession (volatility) that emerged followed the form: exp(-QIRT) * P(exp x) * v(exp y). These empirical relations were compared to rates predicted from the thermodynamics of volatile SiO and SiO(sub x)H(sub Y) reaction products and a kinetic model of diffusion through a moving, boundary [illegible] typical combustion conditions, recession of 0.2 to 2 micron/h is predicted at 1200- 1400C, far in excess of accepta[illegible]erm limits.

Author

Combustion; Reaction Products; Silicon Dioxide; Silicon Nitrides; Turbine Engines; Silicon Carbides; Composite Materials; Combustion Chambers; Volatility

19990066650 California Univ., Mechanical and Aerospace Engineering Dept., Los Angeles, CA USA

Burner Emissions Associated with Lobed and Non-Lobed Fuel Injectors

Mitchell, M. G., California Univ., USA; Smith, L. L., California Univ., USA; Karagozian, A. R., California Univ., USA; Smith, O. I., California Univ., USA; Twenty-Seventh International Symposium on Combustion; 1998, pp. 1825-1831; In English; Combustion, 1998, Unknown; Sponsored by Combustion Inst., USA; Original contains color illustrations

Contract(s)/Grant(s): NCC2-374; N00014-93-1-1383; NASA Order H-2356; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The present experimental study examines NOtsub x), and CO emissions associated with three alternative fuel-injector geometries. These injectors mix fuel and air and strain their interfaces to differing extents and thus create different local equivalence ratios within flow regions upstream of flame ignition and stabilization. Two of the devices studied are lobed fuel injectors, in which molecular mixing of reactants is associated with streamwise vorticity generation, while the third one is a non-lobed fuel injector. Results show that rapid mixing allowed both lobed injector geometries to produce very lean premixed flame structures, with a lower achievable turn-down or fuel/air mass flux ratio than for the analogous non-lobed injector, which largely, produced distinct diffusion flames. All three injectors exhibited some level of sooting near walls and in the far-field region, with the non-lobed injector sooting to the greatest extent. At low fuel flow rates, in which the lobed injectors created locally very lean premixed conditions, there resulted lower NOtsub x) emissions as compared with non-lobed injector emissions. Yet at higher fuel-air mass flux ratios, NOtsub x) emissions from the lobed injectors were actually higher than for the nonlobed injector, likely due to reduced sooting and hence reduced radiative heat losses associated with enhanced mixing. For both lobed injector geometries examined here, CO emissions became high for low values of the fuel/air mass flux ratio, again consistent with locally premixed combustion behavior, despite the fact that fuel was injected separately from air directly into the burner test section. The present study demonstrates that, for fuel-air mixing enhancement devices, control of the local equivalence ratio is critical in order to optimize burner emissions.

Author

Fuel Injection; Injectors; Soot; Lobes; Combustion Efficiency; Combustion Products; Burners; Aircraft Engines

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19990062246 NASA Langley Research Center, Hampton, VA USA

Crossflow Stability and Transition Experiments in Swept-Wing Flow

Dagenhart, J. Ray, NASA Langley Research Center, USA; Saric, William S., Arizona State Univ., USA; July 1999; 152p; In English

Contract(s)/Grant(s): RTOP 522-31-11-03

Report No.(s): NASA/TP-1999-209344; L-17658; NAS 1.60:209344; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

An experimental examination of crossflow instability and transition on a 45 deg swept wing was conducted in the Arizona State University Unsteady Wind Tunnel. The stationary-vortex pattern and transition location are visualized by using both sublimating chemical and liquid-crystal coatings. Extensive hot-wire measurements were obtained at several measurement stations across a single vortex track. The mean and travelling wave disturbances were measured simultaneously. Stationary crossflow disturbance profiles were determined by subtracting either a reference or a span-averaged velocity profile from the mean velocity data. Mean, stationary crossflow, and traveling wave velocity data were presented as local boundary layer profiles and contour plots across a single stationary crossflow vortex track. Disturbance mode profiles and growth rates were determined. The experimental data are compared with predictions from linear stability theory.

Author

Cross Flow; Swept Wings; Flow Stability; Flow Visualization; Laminar Flow; Transition Flow; Wind Tunnel Tests; Vortices

19990063791 NASA Langley Research Center, Hampton, VA USA

Determination of Stability and Control Derivatives Using Computational Fluid Dynamics and Automatic Differentiation

Park, Michael A., George Washington Univ., USA; Green, Lawrence L., NASA Langley Research Center, USA; Montgomery, Raymond C., NASA Langley Research Center, USA; Raney, David L., NASA Langley Research Center, USA; 1999; In English; 17th; Applied Aerodynamics, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Original contains color illustrations

Report No.(s): AIAA Paper 99-3136; Copyright; Avail: Issuing Activity, Hardcopy

With the recent interest in novel control effectors there is a need to determine the stability and control derivatives of new aircraft configurations early in the design process. These derivatives are central to most control law design methods and would

allow the determination of closed-loop control performance of the vehicle. Early determination of the static and dynamic behavior of an aircraft may permit significant improvement in configuration weight, cost, stealth, and performance through multidisciplinary design. The classical method of determining static stability and control derivatives--constructing and testing wind tunnel models--is expensive and requires a long lead time for the resultant data. Wind tunnel tests are also limited to the preselected control effectors of the model. to overcome these shortcomings, computational fluid dynamics (CFD) solvers are augmented via automatic differentiation, to directly calculate the stability and control derivatives. The CFD forces and moments are differentiated with respect to angle of attack, angle of sideslip, and aircraft shape parameters to form these derivatives. A subset of static stability and control derivatives of a tailless aircraft concept have been computed by two differentiated inviscid CFD codes and verified for accuracy with central finite-difference approximations and favorable comparisons to a simulation database.
Author
Aircraft Control; Computational Fluid Dynamics; Control Equipment; Control Theory; Feedback Control; Static Stability; Tailless Aircraft; Sideslip; Aircraft Stability; Controllability; Control Stability

19990063793 NASA Langley Research Center, Hampton, VA USA
X-33 Hypersonic Boundary Layer Transition
Berry, Scott A., NASA Langley Research Center, USA; Horvath, Thomas J., NASA Langley Research Center, USA; Hollis, Brian R., NASA Langley Research Center, USA; Thompson, Richard A., NASA Langley Research Center, USA; Hamilton, H. Harris, II, NASA Langley Research Center, USA; 1999; In English; 33rd, Thermophysics, 28 Jun. - 1 Jul. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations
Report No.(s): AIAA Paper 99-3560; Copyright; Avail: Issuing Activity, Hardcopy

Boundary layer and aeroheating characteristics of several X-33 configurations have been experimentally examined in the Langley 20-Inch Mach 6 Air Tunnel. Global surface heat transfer distributions, surface streamline patterns, and shock shapes were measured on 0.013-scale models at Mach 6 in air. Parametric variations include angles-of-attack of 20-deg, 30-deg, and 40-deg; Reynolds numbers based on model length of 0.9 to 6.6 million; and body-flap deflections of 0, 10 and 20-deg. The effects of discrete and distributed roughness elements on boundary layer transition, which included trip height, size, location, and distribution, both on and off the windward centerline, were investigated. The discrete roughness results on centerline were used to provide a transition correlation for the X-33 flight vehicle that was applicable across the range of reentry angles of attack. The attachment line discrete roughness results were shown to be consistent with the centerline results, as no increased sensitivity to roughness along the attachment line was identified. The effect of bowed panels was qualitatively shown to be less effective than the discrete trips; however, the distributed nature of the bowed panels affected a larger percent of the aft-body windward surface than a single discrete trip.
Author
Aerodynamic Heating; Boundary Layer Transition; Turbulent Boundary Layer; Hypersonic Boundary Layer; Hypersonic Speed; X-33 Reusable Launch Vehicle; Reusable Spacecraft; Three Dimensional Boundary Layer; Laminar Flow; Reynolds Number

19990063968 Rensselaer Polytechnic Inst., Dept. of Mechanical Engineering Aeronautical Engineering and Mechanics, Troy, NY USA
Large Eddy Simulation of Turbulent Flow over an Airfoil Using Unstructured Grids *Final Report, 1 Dec. 1996 - 28 Feb. 1999*
Jansen, Kenneth E.; May 31, 1999; 19p; In English
Contract(s)/Grant(s): F49620-97-1-0043
Report No.(s): AD-A364164; AFRL-SR-BL-TR-99-0147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many flows of aeronautical interest have regions where turbulence has a significant effect. For many of these flows, Reynolds-averaged Navier-Stokes simulation (RANSS) techniques do not give an acceptable description of the flow. In these cases a more detailed simulation of the turbulence is required. One such detailed simulation technique, large-eddy simulation (LES) has matured to the point of application to complex flows. Historically, LES have been carried out with structured grids which suffer from two major difficulties: the extension to higher Reynolds numbers leads to an impractical number of grid points, and most real world flows are rather difficult to represent geometrically with structured grids. Unstructured-grid methods offer a release from both of these constraints. Within this sponsored research significant progress has been made towards the application of the above approach to flows of aeronautical interest.
DTIC
Computational Fluid Dynamics; Fluid Mechanics; Turbulent Flow; Airfoils; Large Eddy Simulation; Computational Grids

19990064124 NASA Langley Research Center, Hampton, VA USA

CFD Calculations for the NLR F-5 DATA: Validation of CFD Technologies for Aeroelastic Applications Using One AVT WG-003 Data Set

Henshaw, Michael J. deC, British Aerospace Public Ltd. Co., UK; Bennett, Robert M., NASA Langley Research Center, USA; Guillemot, Stephane, Dassault-Aviation, France; Geurts, Evert, National Aerospace Lab., Netherlands; Pagano, Antonio, CIRA, Italy; Ruiz–Calavera, Luis P., INTA, Spain; Woodgate, Mark, Glasgow Univ., UK; 1999; 16p; In English; Aeroelasticity and Structural Dynamics 1999, 22-25 Jun. 1999, Williamsburg, VA, USA; Sponsored by National Oceanic and Atmospheric Administration; No Copyright; Avail: Issuing Activity, Hardcopy

The level of sophistication of unsteady CFD(sup 2) methods used within the overall process of aeroelastic prediction has increased significantly in recent years, and, with improved algorithms and more powerful computing capabilities at the disposal of the engineer, it might be expected to advance rapidly in the near future. Particular challenges being addressed are the affordable modelling of complex geometries (up to full aircraft), and transonic flow conditions for phenomena such as flutter prediction. A key aspect of affordability is likely to be application of the most appropriate technology for the particular design phase being addressed. RTO WG-003(suaup 3) has compiled a database for unsteady CFD verification and validation which comprises primarily experimental data, but supported by CFD data where appropriate; the overall activity is reported in another paper submitted to this forum (Ref. 1). Within this context a benchmarking exercise has been carried out covering a variety of established unsteady CFD technologies using data from a series of tests conducted at NLR(sup 4) on the F-5 wing (Ref. 3). This series of tests provided an extensive set of data for configurations of increasing complexity (from clean wing through to wing with pylon, store and tip missile with launcher) appropriate for validation of methods within the context of development. It is anticipated that this test case will form a useful first case for validation of new unsteady CFD methods, and that the CFD results included within the database will help to clarify the experimental features, and provide some benchmark results against which developers can validate their codes. This paper briefly overviews the benchmarking exercise and the CFD chapter to appear in the AVT WG-003 publication.

Author

Computational Fluid Dynamics; Prediction Analysis Techniques; Aeroelasticity; Transonic Flow; Flutter Analysis; Data Bases

19990064263 Oklahoma State Univ., School of Mechanical and Aerospace Engineering, Stillwater, OK USA

Aeroservoelastic and Flight Dynamics Analysis Using Computational Fluid Dynamics *Final Report, 30 Apr. 1998 - 30 Apr. 1999*

Arena, Andrew S., Jr., Oklahoma State Univ., USA; 1999; 204p; In English

Contract(s)/Grant(s): NAG4-154; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This document in large part is based on the Masters Thesis of Cole Stephens. The document encompasses a variety of technical and practical issues involved when using the STARS codes for Aeroservoelastic analysis of vehicles. The document covers in great detail a number of technical issues and step-by-step details involved in the simulation of a system where aerodynamics, structures and controls are tightly coupled. Comparisons are made to a benchmark experimental program conducted at NASA Langley. One of the significant advantages of the methodology detailed is that as a result of the technique used to accelerate the CFD-based simulation, a systems model is produced which is very useful for developing the control law strategy, and subsequent high-speed simulations.

Derived from text

Computational Fluid Dynamics; Aeroservoelasticity; Control Theory; Aerodynamics

19990064494 University of South Alabama, Mechanical Engineering Dept., Mobile, AL USA

Inviscid Interactions Between Wake Vortices and Shear Layers

Zheng, Z. C., University of South Alabama, USA; Baek, K., University of South Alabama, USA; Journal of Aircraft; 1998; Volume 36, No. 2, pp. 477-480; In English

Contract(s)/Grant(s): NAG1-1911; Copyright; Avail: Issuing Activity, Hardcopy

Aircraft trailing vortices can be influenced significantly by atmospheric conditions such as crosswind, turbulence, and stratification. According to the NASA 1994 and 1995 field measurement program in Memphis, Tennessee, the descending aircraft wake vortices could stall or be deflected at the top of low-level temperature inversions that usually produce pronounced shear zones. Numerical simulations of vortex/shear interactions with ground effects have been performed by several groups. Burnham used a series of evenly spaced line vortices at a particular altitude to model the ground shear layer of the cross- wind. He found that the wind shear was swept up around the downwind vortex and caused the downwind vortex to move upward, and claimed that the effect was actually produced by the vertical gradient in the wind shear rather than by the wind shear directly, because uniformly distributed wind-shear vortices would have no effect on the trailing vortex vertical motion. Recently, Proctor et al.

numerically tested the effects of narrow shear zones on the behavior of the vortex pair, motivated by the observation of the Memphis field data. The shear-layer sensitivity tests indicated that the downwind vortex was more sensitive and deflected to a higher altitude than its upwind counterpart. The downstream vortex contained vorticity of opposite sign to that of the shear. There was no detectable preference for the downwind vortex (or upwind vortex) to weaken (or strengthen) at a greater rate.
Derived from text
Vortices; Shear Layers; Wind Shear; Inviscid Flow; Aircraft Wakes

19990064529 University of South Alabama, Dept. of Mechanical Engineering, Mobile, AL USA
Initialization and Simulations of Three-Dimensional Aircraft Wake Vortices *Final Report, 1 Feb. 1997 - 30 Apr. 1999*
Zheng, Zhongquan Charlie, University of South Alabama, USA; 1999; 6p; In English
Contract(s)/Grant(s): NAG1-1911; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The research period under the sponsorship of NAG1-1911 is two years: from Feb. 1, 1997 to Jan. 31, 1999 (extended no-cost to April 30, 1999). During the two-year research period, deliverables have included brief monthly progress statements, annual reports and subroutines of computational programs. Several technical papers have been published and are attached to this final report. This Summary of Research contains a brief description of those research results and refers the details to each attached paper.
Author
Aircraft Wakes; Vortices; Velocity

19990064620 NASA Glenn Research Center, Cleveland, OH USA
Parametric Experimental Study of the Formation of Glaze Ice Shapes on Swept Wings
Vargas, Mario, NASA Glenn Research Center, USA; Reshotko, Eli, Case Western Reserve Univ., USA; 19990601; 22p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Original contains color illustrations
Contract(s)/Grant(s): RTOP 548-20-23
Report No.(s): NASA/TM-1999-108900; NAS 1.15:208900; E-11499; AIAA Paper 99-0094; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An experiment was conducted to study the effect of velocity and sweep angle on the critical distance in ice accretion formation on swept wings at glaze ice conditions. The critical distance is defined as the distance from the attachment line to the beginning of the zone where roughness elements develop into glaze ice feathers. Icing runs were performed on a NACA 0012 swept wing tip at velocities of 75, 100, 150, and 200 miles per hour. At each velocity and tunnel condition, the sweep angle was changed from 0 deg to 45 deg at 5 deg increments. Casting data, ice shape tracings, and close-up photographic data were obtained. The results showed that at given velocity and tunnel conditions, as the sweep angle is increased from 0 deg to 25 deg the critical distance slowly decreases. As the sweep angle is increased past 25 deg, the critical distance starts decreasing more rapidly. For 75 and 100 mph it reaches a value of 0 millimeters at 35 deg. For 150 and 200 mph it reaches a value of 0 millimeters at 40 deg. On the ice accretion, as the sweep angle is increased from 0 deg to 25 deg, the extent of the attachment line zone slowly decreases. In the glaze ice feathers zone, the angle that the preferred direction of growth of the feathers makes with respect to the attachment line direction increases. But overall, the ice accretions remain similar to the 0 deg sweep angle case. As the sweep angle is increased above 25 deg, the extent of the attachment line zone decreases rapidly and complete scallops form at 35 deg sweep angle for 75 and 100 mph, and at 40 deg for 150 and 200 mph.
Author
Glazes; Shapes; Experimentation; Swept Wings; Ice Formation

19990063447 Lamar Univ., Dept. of Mechanical Engineering, Beaumont, TX USA
Numerical Investigation of the ARMSEF Arc-Jet *Final Report*
Cox, Carey F., Lamar Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1998; May 1999; Volume 1, pp. 6-1 - 6-12; In English; See also 19990063441
Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The NASA/JSC 10 MW Atmospheric Reentry Materials and Structures Evaluation Facility (ARMSEF) is used for the development and evaluation of thermal protection systems for manned reentry vehicles. In an effort at better understanding the flow characteristics of an arc-jet wind tunnel and hence the correlation between simulation and actual flight conditions, preliminary numerical analyses have been made. Difficulties in defining inlet boundary conditions to the plenum chamber, where there is very little usable experimental data, are discussed. Two different boundary conditions for the plenum, a straight profile and parabolic profile, are employed to describe the conditions in this very important flow defining region. Comparisons are made

to experimental data with the results showing that some type of parabolic or step profile is needed to adequately resolve the strong core flow that is present in the nozzle and plume region. Recommendations are made regarding future efforts in analyzing this challenging flow field.

Author

Reentry Vehicles; Thermal Protection; Aircraft Construction Materials; Wind Tunnels; Numerical Analysis; Plenum Chambers; Flight Simulation; Atmospheric Entry

19990063804 Cummins Engine Co., Inc., Columbus, IN USA

Development of Advanced In-Cylinder Components and Tribological Systems for Low Heat Rejection Diesel Engines *Final Report*

Younushonis, T. M., Cummins Engine Co., Inc., USA; Wiczynski, P. D., Cummins Engine Co., Inc., USA; Myers, M. R., Cummins Engine Co., Inc., USA; Anderson, D. D., Cummins Engine Co., Inc., USA; McDonald, A. C., Cummins Engine Co., Inc., USA; Weber, H. G., Cummins Engine Co., Inc., USA; Richardson, D. E., Cummins Engine Co., Inc., USA; Stafford, R. J., Cummins Engine Co., Inc., USA; Naylor, M. G., Cummins Engine Co., Inc., USA; June 1999; 290p; In English

Contract(s)/Grant(s): DEN3-375; DE-AI05-960R22547

Report No.(s): NASA/CR-1999-209163; E-11749; DOE/NASA/0375-2; ARL-CR-442; NAS 1.26:209163; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

In-cylinder components and tribological system concepts were designed, fabricated and tested at conditions anticipated for a 55% thermal efficiency heavy duty diesel engine for the year 2000 and beyond. A Cummins L10 single cylinder research engine was used to evaluate a spherical joint piston and connecting rod with 19.3 MPa (2800 psi) peak cylinder pressure capability, a thermal fatigue resistant insulated cylinder head, radial combustion seal cylinder liners, a highly compliant steel top compression ring, a variable geometry turbocharger, and a microwave heated particulate trap. Components successfully demonstrated in the final test included spherical joint connecting rod with a fiber reinforced piston, high conformability steel top rings with wear resistant coatings, ceramic exhaust ports with strategic oil cooling and radial combustion seal cylinder liner with cooling jacket transfer fins. A Cummins 6B diesel was used to develop the analytical methods, materials, manufacturing technology and engine components for lighter weight diesel engines without sacrificing performance or durability. A 6B diesel engine was built and tested to calibrate analytical models for the aluminum cylinder head and aluminum block.

Author

Diesel Engines; Engine Parts; Mathematical Models; Superchargers; Thermodynamic Efficiency; Tribology; Engine Tests

19990064381 NASA Glenn Research Center, Cleveland, OH USA

Probabilistic Analysis of Aircraft Gas Turbine Disk Life and Reliability

Melis, Matthew E., NASA Glenn Research Center, USA; Zaretsky, Erwin V., NASA Glenn Research Center, USA; August, Richard, NYMA, Inc., USA; June 1999; 30p; In English

Contract(s)/Grant(s): NAS3-27186; RTOP 523-22-13

Report No.(s): NASA/TM-1999-107436; NAS 1.15:107436; E-10629-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two series of low cycle fatigue (LCF) test data for two groups of different aircraft gas turbine engine compressor disk geometries were reanalyzed and compared using Weibull statistics. Both groups of disks were manufactured from titanium (Ti-6Al-4V) alloy. A NASA Glenn Research Center developed probabilistic computer code Probable Cause was used to predict disk life and reliability. A material-life factor A was determined for titanium (Ti-6Al-4V) alloy based upon fatigue disk data and successfully applied to predict the life of the disks as a function of speed. A comparison was made with the currently used life prediction method based upon crack growth rate. Applying an endurance limit to the computer code did not significantly affect the predicted lives under engine operating conditions. Failure location prediction correlates with those experimentally observed in the LCF tests. A reasonable correlation was obtained between the predicted disk lives using the Probable Cause code and a modified crack growth method for life prediction. Both methods slightly overpredict life for one disk group and significantly under predict it for the other.

Author

Aircraft Engines; Gas Turbine Engines; Probability Theory; Reliability; Failure Analysis; Life (Durability)

19990064445 Massachusetts Univ., Dept. of Mechanical Engineering, Amherst, MA USA

Experimental Evaluation of a Structure-Based Connectionist Network for Fault Diagnosis of Helicopter Gearboxes

Jammu, V. B., Massachusetts Univ., USA; Danai, K., Massachusetts Univ., USA; Lewicki, D. G., Army Research Lab., USA; Journal of Mechanical Design; March 1998; Volume 120, pp. 106-112; In English

Contract(s)/Grant(s): RTOP 581-30-13; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents the experimental evaluation of the Structure-Based Connectionist Network (SBCN) fault diagnostic system introduced in the preceding article. For this vibration data from two different helicopter gearboxes: OH-58A and S-61, are used. A salient feature of SBCN is its reliance on the knowledge of the gearbox structure and the type of features obtained from processed vibration signals as a substitute to training. to formulate this knowledge, approximate vibration transfer models are developed for the two gearboxes and utilized to derive the connection weights representing the influence of component faults on vibration features. The validity of the structural influences is evaluated by comparing them with those obtained from experimental RMS values. These influences are also evaluated ba comparing them with the weights of a connectionist network trained though supervised learning. The results indicate general agreement between the modeled and experimentally obtained influences. The vibration data from the two gearboxes are also used to evaluate the performance of SBCN in fault diagnosis. The diagnostic results indicate that the SBCN is effective in directing the presence of faults and isolating them within gearbox subsystems based on structural influences, but its performance is not as good in isolating faulty components, mainly due to lack of appropriate vibration features.

Author

Evaluation; Experimentation; Fault Detection; S-61 Helicopter; Transmissions (Machine Elements)

19990064096 Colorado Univ., College of Engineering, Boulder, CO USA

Euler Flow Computations on Non-Matching Unstructured Meshes

Gumaste, Udayan, Colorado Univ., USA; June 1999; 202p; In English

Contract(s)/Grant(s): NAG3-1425; NSF ECS-92-17394; NSF GER-93-55046; RTOP 523-22-13

Report No.(s): NASA/CR-1999-209155; NAS 1.26:209155; E-11702; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Advanced fluid solvers to predict aerodynamic performance-coupled treatment of multiple fields are described. The interaction between the fluid and structural components in the bladed regions of the engine is investigated with respect to known blade failures caused by either flutter or forced vibrations. Methods are developed to describe aeroelastic phenomena for internal flows in turbomachinery by accounting for the increased geometric complexity, mutual interaction between adjacent structural components and presence of thermal and geometric loading. The computer code developed solves the full three dimensional aeroelastic problem of-stage. The results obtained show that flow computations can be performed on non-matching finite-volume unstructured meshes with second order spatial accuracy.

Author

Forced Vibration; Structural Design; Aerodynamic Characteristics; Finite Volume Method; Turbomachinery; Aeroelasticity; Computational Fluid Dynamics; Internal Flow

19990066696 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Static and Dynamic Analysis of Structural Frameworks Comprised of Inflatable Arches and Beams *Final Report, 1 May 1995 - 31 Dec. 1998*

Plaut, Raymond H., Virginia Polytechnic Inst. and State Univ., USA; Kapania, Rakesh K., Virginia Polytechnic Inst. and State Univ., USA; Mar. 30, 1998; 6p; In English

Contract(s)/Grant(s): DAAH04-95-1-0175

Report No.(s): AD-A365376; ARO-33421.14-EG; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

This project investigated the behavior of large tent-like structures supported by pressurized arch-shaped tubes. These structures are to be used by the U.S. Army as temporary maintenance shelters for helicopters and airplanes. Similar structures exist, but they are much smaller than those required for this purpose. The aim is to develop a structure that can be separated into lightweight modules which would be easy to transport, deploy, and disassemble. One part of the research program involved a study of two pressurized arches that lean against each other. This configuration can be an effective component in supporting a fabric shelter. The behavior of single arch-tubes also was analyzed. Deflections, vibrations, and stability were investigated under various types of snow and wind loading conditions. Critical values of the loads were determined. The effects of changing material properties, temperature, and moisture were examined. A finite element model of the entire tent structure was developed. A numerical optimization study of the supporting arches was conducted. Finally, two physical models of the entire structure were constructed. They were placed in a wind tunnel and tested under various wind speeds and orientations. Then they were tested under simulated snow loads until failure occurred.

DTIC

Structural Analysis; Finite Element Method; Inflatable Structures; Beams (Supports); Hangars

13
GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19990064125 Computational Physics, Inc., Fairfax, VA USA

Mesoscale Variability in SUCCESS Data *Annual Report, 1 Oct. 1997 - 30 Sep. 1998*

Eckermann, Stephen D., Computational Physics, Inc., USA; September 1998; 82p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-97247; NRA-96-OA-01

Report No.(s): NASA/CR-1999-209461; NAS 1.26:209461; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Analysis of meteorological, chemical, and microphysical data from the airborne SUCCESS mission is reported. Careful analysis of the complex DC-8 flight pattern of May 2, 1996 reveals 19 linear or nearly linear flight segments within six main geographical areas, which we have analyzed. Significant mountain wave activity is revealed in the data from the MMS and MTP instruments on the DC-8, which resembles previous observations of mountain wave structures near Boulder, CO. Strong mountain-wave-induced upwelling downwind of the Rockies is noted. Turbulence is also noted in regions of the mountain wave consistent with overturning near the tropopause. Zonal winds recorded on the ER-2 are shown to consistent with mountain wave breaking at or near critical levels in the stratosphere, consistent with the strong turbulence reported by the pilot during the ER-2 flight. Those observations have been supported with spectral analyses and modeling studies. "Postcasts" of mountain wave activity on May 2, 1996, using the Naval Research Laboratory Mountain Wave Forecast Model (NRL/MWFM) predicts both strong mountain wave activity near the tropopause (as measured by the DC-8) and strong mountain-wave-induced turbulence in the stratosphere (as encountered by the ER-2). Two-dimensional simulations of fluid flow over topography reveal similar isentropic structures to observations.

Author

Mesoscale Phenomena; Computer Programs; Multimission Modular Spacecraft; DC 8 Aircraft; Meteorological Parameters; Mathematical Models; Data Processing

19990064459 NASA Goddard Space Flight Center, Greenbelt, MD USA

Geoscience Applications of Airborne and Spaceborne Lidar Altimetry

Harding David J., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 27 Apr. 1999, Ithaca, NY, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recent advances in lidar altimetry technology have enabled new methods to describe the vertical structure of the Earth's surface with great accuracy. Application of these methods in several geoscience disciplines will be described. Airborne characterization of vegetation canopy structure will be illustrated, including a validation of lidar-derived Canopy Height Profiles for closed-canopy, broadleaf forests. Airborne detection of tectonic landforms beneath dense canopy will also be illustrated, with an application mapping active fault traces in the Puget Lowland of Washington state for earthquake hazard assessment purposes. Application of data from the first and second flights of the Shuttle Laser Altimeter will also be discussed in an assessment of global digital elevation model accuracy and error characteristics. Two upcoming space flight missions will be described, the Vegetation Canopy Lidar (VCL) and the Ice, Cloud and Land Elevation Mission (ICESat), which will provide comprehensive lidar altimeter observations of the Earth's topography and vegetation cover.

Author

Vertical Distribution; Airborne Equipment; Altimeters; Elevation; Geophysics; Laser Altimeters; Optical Radar

19990063855 NASA Goddard Space Flight Center, Greenbelt, MD USA

TurboBrayton Cryocooler: A Flight Worthy and Promising Future

Gibbon, Judith A., NASA Goddard Space Flight Center, USA; Swift, Walt L., Creare, Inc., USA; Zagarola, Mark V., Creare, Inc., USA; DiPirro, Mike, NASA Goddard Space Flight Center, USA; Whitehouse, Paul, NASA Goddard Space Flight Center, USA; 1999; 8p; In English; Cryogenic Engineering, Jul. 1999, Montreal, Canada

Contract(s)/Grant(s): NAS5-31281; Copyright; Avail: Issuing Activity, Hardcopy

A new development in cryocooler technology, a reverse TurboBrayton cycle cryocooler, developed by Creare, Inc. of Hanover, NH, has now been flight tested. This cooler provides high reliability and long life. With no linear moving components common in current flight cryocoolers, the TurboBrayton cooler requires no active control systems to provide a vibration-free signature. The cooler provides first stage cooling for advanced cryogenic systems and serves as a direct replacement for stored cryogen systems with a longer lifetime. Following a successful flight on STS-95, a TurboBrayton cryocooler will be flown on

Hubble Space Telescope (HST) in 2000 to provide renewed refrigeration capability for the Near Infrared Camera and Multi-Object Spectrometer (NICMOS). The TurboBrayton cycle cooler is a promising technology already being considered for additional flight programs such as Next Generation Space Telescope (NGST) and Constellation X. These future missions require an advanced generation of the cooler that is currently under development to provide cooling at 10K and less. This paper presents an overview of the current generation cooler with recent flight test results and details the current plans and development progress on the next generation TurboBrayton technology for future missions.
Author
Cryogenics; Cryogenic Cooling; Cryogenic Equipment; Coolers; Brayton Cycle; Gas Turbine Engines; Turbojet Engines

19990063905 Environmental Protection Agency, Office of Mobile Sources, Ann Arbor, MI USA
Evaluation of Air Pollutant Emissions from Subsonic Commercial Jet Aircraft *Final Report*
Apr. 1999; 136p; In English
Report No.(s): PB99-153611; EPA/420/R-99/013; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

The Environmental Protection Agency's (EPA) Office of Mobile sources initiated this study in order to assess the existing and potential impact of aircraft emissions on local air quality at ten selected cities. The scope of this study: (1) selected ten cities with current or potential local air quality problems; (2) estimated the emissions from commercial jet aircraft only (on board auxiliary power units excluded); (3) relied on the methodology in EPA's Procedures for Emission Inventory Preparation, Volume 4: Mobile Sources, 1992 (PB92-209386); (4) sought data from sources that are national in scope and readily available, and (5) used 1990 as the base year, with 2010 as the projection year for potential emissions growth. This study confirms that commercial aircraft emissions significantly contribute to air pollution in the ten study areas. This study creates a basis understanding of ground-level aircraft emissions contribution, verifies that investigation of cost-effective control options on aircraft emissions is warranted, and highlights the need for improvements in the quality of national level data if more certainty is desired.
NTIS
Air Pollution; Exhaust Emission; Subsonic Flow; Commercial Aircraft; Contaminants; Environment Protection

19990064481 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Lagrangian Simulation of Subsonic Aircraft Exhaust Emissions
Schoeberl, M. R., NASA Goddard Space Flight Center, USA; Morris, G. A., Valparaiso Univ., USA; [1999]; 19p; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity, Hardcopy

To estimate the effect of subsonic and supersonic aircraft exhaust on the stratospheric concentration of NO(y), we employ a trajectory model initialized with air parcels based on the standard release scenarios. The supersonic exhaust simulations are in good agreement with 2D and 3D model results and show a perturbation of about 1-2 ppbv of NO(y) in the stratosphere. The subsonic simulations show that subsonic emissions are almost entirely trapped below the 380 K potential temperature surface. Our subsonic results contradict results from most other models, which show exhaust products penetrating above 380 K, as summarized. The disagreement can likely be attributed to an excessive vertical diffusion in most models of the strong vertical gradient in NO(y) that forms at the boundary between the emission zone and the stratosphere above 380 K. Our results suggest that previous assessments of the impact of subsonic exhaust emission on the stratospheric region above 380 K should be considered to be an upper bound.
Author
Lagrangian Function; Simulation; Subsonic Flow; Exhaust Emission; Estimating; Supersonic Flow; Supersonic Aircraft

19990069937 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA
The Role of HO(x) in Super- and Subsonic Aircraft Exhaust Plumes
Hanisco, T. F., Harvard Univ., USA; Wennberg, P. O., Harvard Univ., USA; Cohen, R. C., Harvard Univ., USA; Anderson, J. G., Harvard Univ., USA; Fahey, D. W., National Oceanic and Atmospheric Administration, USA; Keim, E. R., National Oceanic and Atmospheric Administration, USA; Gao, R. S., National Oceanic and Atmospheric Administration, USA; Wamsley, R. C., National Oceanic and Atmospheric Administration, USA; Donnelly, S. G., National Oceanic and Atmospheric Administration, USA; DelNegro, L. A., National Oceanic and Atmospheric Administration, USA; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Kelly, K. K., National Oceanic and Atmospheric Administration, USA; Proffitt, M. H., National Oceanic and Atmospheric Administration, USA; Geophysical Research Letters; Jan. 01, 1997; ISSN 0094-8534; Volume 24, No. 1, pp. 65-68; In English
Report No.(s): Paper-96GL03724; Copyright; Avail: Issuing Activity, Hardcopy

The generation of sulfuric acid aerosols in aircraft exhaust has emerged as a critical issue in determining the impact of supersonic aircraft on stratospheric ozone. It has long been held that the first step in the mechanism of aerosol formation is the oxidation of SO2 emitted from the engine by OH in the exhaust plume. We report in situ measurements of OH and HO2 in the exhaust plumes of a supersonic (Air France Concorde) and a subsonic (NASA ER-2) aircraft in the lower stratosphere. These measurements imply that reactions with OH are responsible for oxidizing only a small fraction of SO2 (2%), and thus cannot explain the large number of particles observed in the exhaust wake of the Concorde.

Author

Supersonic Aircraft; Exhaust Gases; Combustion Products; Air Pollution; Sulfuric Acid; Aerosols; Plumes; Atmospheric Composition

19990066712 NASA Langley Research Center, Hampton, VA USA

Radiometric Performance of the Clouds and The Earth's Radiant Energy System (CERES) Proto-Flight Model on the Tropical Rainfall Measuring Mission (TRMM) Spacecraft for 1998

Priestley, Kory J., NASA Langley Research Center, USA; Lee, Robert B., III, NASA Langley Research Center, USA; Green, Richard N., NASA Langley Research Center, USA; Thomas, Susan, Science Applications International Corp., USA; Wilson, Robert S., Science Applications International Corp., USA; 1999; 6p; In English; 10th; Atmospheric Radiation, 28 Jun. - 2 Jul. 1999, Madison, WI, USA; Sponsored by American Meteorological Society; Copyright; Avail: Issuing Activity, Hardcopy

On November 27, 1997 the CERES Proto-Flight Model (PFM) instrument package was launched on the NASA Tropical Rainfall Measuring Mission (TRMM) spacecraft National Space Development Agency) NASA /Japan launch vehicle placed the TRMM spacecraft into a low-inclination 35-deg, 350-km altitude orbit. Analysis of the first thirteen months of on-orbit internal calibration and calibration validation studies indicate that the ground-based radiometric calibrations, which were tied to ITS'90 have been successfully carried into orbit to within 0.12, 0.08, and 0.29 percent for the Total, Window and Shortwave channels respectively. Additionally, these analyses have indicated that on-orbit radiometric stability has remained at levels of better than 0.13, 0.2 and 0.2-percent for the Total Window and Shortwave channels. In TOA these levels correspond to magnitudes of less than 0.3, 0.2 and 0.15 v /sq m.

Author

Radiometers; Radiant Flux Density; Flight Instruments; Trmm Satellite; Magnetic Clouds

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19990063460 Mercer Univ., Div. of Basic Medical Sciences, Macon, GA USA

Influence of High Aspect Ratio Vessel Cell Culture on TNF-Alpha, Insulin Secretion and Glucose Homeostasis in Pancreatic Islets of Langerhans from Wistar Furth Rats *Final Report*

Tobin, Brian W.a, Mercer Univ., USA; Leeper-Woodford, Sandra K., Mercer Univ., USA; National Aeronautics and Space Administration (NASA)/American Society for Engineering Education (ASEE) Summer Faculty Fellowship Program, 1998; May 1999; Volume 1, pp. 19-1 - 19-24; In English; See also 19990063441

Contract(s)/Grant(s): NAG9-867; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The present studies were carried out to determine the influence of a ground based microgravity paradigm, utilizing the High Aspect Ratio Vessel (HARV) cell culture upon lipopolysaccharide (LPS) stimulated tumor necrosis factor alpha (TNF-alpha) production of pancreatic islets of Langerhans. An additional aim was to elucidate alterations in insulin secretion and glucose utilization using the HARV low shear, gravity averaged vector, cell culture technique. Islets were isolated (1726 +/- 117, 150 micron islet equivalent units) from Wistar Furth rats and assigned to four treatment groups: 1) HARV, 2) HARV plus LPS, 3) static culture, 4) static culture plus LPS. Following 48 hours of culture, insulin concentration was increased in both HARV and static cultures (pis less than 0.05). Islet medium from HARV and static cultures were assayed for TNF-alpha (L929 cytotoxicity assay) and was measured at selected time points for 48 hours. TNF-alpha was significantly increased in LPS-induced HARV and static cultures, yet the increase was more pronounced in the static culture group (pis less than 0.05). This is a novel observation and indicates that TNF producing cells are present in islets and that LPS stimulates TNF secretion in isolated islets. A decrease in insulin concentration was demonstrated in the islet medium of the LPS stimulated HARV culture (pis less than 0.05). That TNF-alpha is associated with a decreased insulin secretion is intriguing, both as it relates to in-flight investigations, and as it may provide insight into the pathophysiology of Type I and Type II diabetes. Glucose concentration in islet medium was lesser throughout the experiment in static cultures, suggesting a decreased reliance upon glucose as a metabolic substrate in the islets

cultured in HARVS. In conclusion, the present studies demonstrate alterations in LPS induced TNF-alpha production of pancreatic islets of Langerhans, favoring a lesser TNF production in the microgravity HARV paradigm. Additionally, alterations in fuel homeostasis may be promulgated by HARV culture. The clinical and physiological significance of these observations remains to be determined.

Author

Glucose; Homeostasis; Metabolism; Microgravity; Gravitational Effects; Physiological Effects; High Aspect Ratio; Insulin; Rats

19990063635 NASA Ames Research Center, Moffett Field, CA USA

Principles and Guidelines for Duty and Rest Scheduling in Commercial Aviation

Dinges, David F., Pennsylvania Univ., USA; Graeber, R. Curtis, Boeing Commercial Airplane Co., USA; Rosekind, Mark R., NASA Ames Research Center, USA; Samel, Alexander, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; May 1996; 16p; In English

Contract(s)/Grant(s): RTOP 505-64-53

Report No.(s): NASA/TM-1996-110404; A-961924; NAS 1.15:110404; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The aviation industry requires 24-hour activities to meet operational demands. Growth in global long-haul, regional, overnight cargo, and short-haul domestic operations will continue to increase these round-the-clock requirements. Flight crews must be available to support 24-hour-a-day operations to meet these industry demands. Both domestic and international aviation can also require crossing multiple time zones. Therefore, shift work, night work, irregular work schedules, unpredictable work schedules, and dm zone changes will continue to be commonplace components of the aviation industry. These factors pose known challenges to human physiology, and because they result in performance-impairing fatigue, they pose a risk to safety. It is critical to acknowledge and, whenever possible, incorporate scientific information on fatigue, human sleep, and circadian physiology into 24-hour aviation operations. Utilization of such scientific information can help promote crew performance and alertness during flight operations and thereby maintain and improve the safety margin.

Author

Commercial Aircraft; Scheduling; Sleep; Human Performance; Airline Operations; Flight Operations

19990068480 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France

Aeromedical Aspects of Aircrew Training *Les Aspects Aeromedicaux de la Formation des Equipages*

June 1999; 96p; In English, 14-18 Oct. 1998, San Diego, CA, USA; See also 19990068481 through 19990068496

Report No.(s): RTO-MP-21; AC/323(HFM)TP/8; ISBN 92-837-1016-9; Copyright Waived; Avail: CASI; A05, Hardcopy; A01, Microfiche

A RTO Human Factors and Medicine Panel Workshop held in San Diego, California, in October 1998 brought together Aeromedical Trainers to discuss current Aeromedical Training Programs and to present new approaches to this training. Various approaches to Aeromedical Training were also discussed and STANAG 3114 "Aeromedical Training of Flight Personnel" was reviewed. Presentations included: categories of training, subjects taught, frequency of training, duration of courses, period of validity and altitude chamber profiles utilized. Most NATO countries were present and provided overviews of their programs, as did representatives from Poland and the Czech Republic. Presentations also included new approaches to Aeromedical Training including: Simulator Based Physiology Training (SYMPHYS), Simulator Based Disorientation Training and In-Flight Disorientation Training. The Workshop recommended changes to STANAG 3114 including, but not limited to: removal of the split between Rotary and Fixed-wing aircraft training requirements, addition of the requirement for instruction on aeromedical aspects of new Life Support Equipment and addition of the requirement for a practical Spatial Disorientation experience during refresher training. Also recommended was the establishment of a Working Group to study the variation between countries in rates of Decompression Illness from altitude chamber exposure. It was also recommended that NATO validate the need for a new STANAG on Night Vision Training.

Author

Aerospace Medicine; Human Factors Engineering; Training Devices; Training Simulators; Flight Training; Flight Simulation; Altitude Simulation; Flight Crews

19990068493 Headquarters Army Aviation, Middle Wallop, UK

In-Flight Demonstration of Spatial Disorientation in the British Army

Braithwaite, M. G., Headquarters Army Aviation, UK; Aeromedical Aspects of Aircrew Training; June 1999, pp. 17-1 - 17-9; In English; See also 19990068480; Copyright Waived; Avail: CASI; A02, Hardcopy; A01, Microfiche

Following didactic instruction, most aircrew are able to experience some of the disorientating illusions and limitations of the orientational senses in a variety of ground-based devices. In order to reinforce instruction in spatial disorientation (SD) within environment in which they operate, British Army Air Corps helicopter pilots also receive an airborne demonstration of the limitations of their orientation senses. Since 1982, a specific SD sortie has been programmed towards the end of the basic rotary-wing phase of flight training approximately 6 weeks after the aeromedical training module, and before students commence rotary-wing instrument flight training. Refresher sorties are flown every 4 years. The conduct of the SD sortie is described in detail. Analysis of helicopter accidents demonstrates that this training is operationally effective by contributing towards the reduction of SD-related mishaps. It is cost-effective and the addition of this type of in-flight demonstration to the aeromedical training syllabus is regarded as being of great value to British Army helicopter aircrew. Similar instruction could be readily adopted by other services.

Author

Aerospace Medicine; Aircraft Pilots; Flight Crews; Flight Training; Education; Pilot Training; Armed Forces (Foreign); UK

19990069622 Pittsburgh Univ., Inst. for Aviation Medicine and Safety, Pittsburgh, PA USA

The Effects of Age and Practice on Aviation-Relevant Concurrent Task Performance *Final Report*

Milke, Ramon M., Pittsburgh Univ., USA; Becker, James T., Pittsburgh Univ., USA; Lambrou, Peter, Pittsburgh Univ., USA; Harris, Howard C., Jr., Civil Aeromedical Inst., USA; Schroeder, David J., Civil Aeromedical Inst., USA; August 1999; 20p; In English

Contract(s)/Grant(s): FAA-AM-A-94-HRR-126

Report No.(s): DOT/FAA/AM-98/22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent reviews of the relationship between aging, cognition, and performance in pilots have emphasized the importance of considering age effects in aviator skills, particularly perceptual-motor, and memory. One possible conclusion is that flight experience does not appear to modify this age performance relationship, except in aviator's ability to time-share. A recent study involving the administration of an aviation-relevant neuropsychological test battery over two days provided data to examine the extent to which experience moderates the effects of aging on performance. Sixty individuals ranging in age from 20 to 65 years completed the CogScreen computerized neuropsychological test battery on five occasions on two consecutive days. Subjects were divided into three age groups of equal size and within-subject repeated measures analyses of variance (ANOVA) examined the relationship between chronological age and practice on performance. The performance of the subjects in the oldest group was consistently poorer and slower than that of the subjects in the youngest group for all of the measures. There were main effects of practice such that performance after five sessions was significantly better than that on the first practice session. On none of the measures was there a significant age by practice interaction. In the case of divided attention tasks, significant age by condition (single vs. concurrent) interactions revealed that concurrent task performance by the elderly was differentially affected, depending on the information processing demands. These data are consistent with previous reports of experience-based practice effects differentiating subjects based on age and, by extension, suggesting that age-related factors be considered during systems design and implementation (including task execution and training for new equipment).

Author

Age Factor; Psychological Tests; Human Performance; Cognitive Psychology; Aircraft Pilots

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19990063477 Australian National Univ., Centre for Visual Science, Canberra, Australia

Insect-Based Vision for Autonomous Vehicles: A Feasibility Study *Final Report*

Srinivasan, Mandyam V., Australian National Univ., Australia; 1999; 10p; In English

Contract(s)/Grant(s): NAG2-1252; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The aims of the project were to use a high-speed digital video camera to pursue two questions: i) to explore the influence of temporal imaging constraints on the performance of vision systems for autonomous mobile robots; To study the fine structure of insect flight trajectories with in order to better understand the characteristics of flight control, orientation and navigation.

Derived from text

Imaging Techniques; Fine Structure; Robots; Autonomy; Flight Control

19990063496 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

11th VPI&SU Symposium on Structural Dynamics and Control *Final Report, 1 May - 31 Dec. 1997*

Inman, Daniel J.; May 18, 1999; 12p; In English

Contract(s)/Grant(s): F49620-97-1-0303

Report No.(s): AD-A364311; AFRL-SR-BL-TR-99-0148; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This grant was in support of the conference entitled, "11th VPI&SU Symposium on Structural Dynamics and Control." The symposium was held on the campus of Virginia Polytechnic Institute and State University (Virginia Tech) in Blacksburg, Virginia, on May 12 - 14, 1997. The symposium consisted of 65 papers presented over a three-day period. The results of the conference have been published in a bound volume entitled, Structural Dynamics and Control.

DTIC

Aeroelasticity; Noise Reduction; Structural Engineering; Dynamic Structural Analysis; Dynamic Response; Dynamic Control

19990069898 NASA Langley Research Center, Hampton, VA USA

Synthesis of Optimal Constant-Gain Positive-Real Controllers for Passive Systems

Mao, Y., Kansas State Univ., USA; Kelkar, A. G., Kansas State Univ., USA; Joshi, S. M., NASA Langley Research Center, USA; 1999; In English; American Control, 2-4 Jun. 1999, San Diego, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

This paper presents synthesis methods for the design of constant-gain positive real controllers for passive systems. The results presented in this paper, in conjunction with the previous work by the authors on passification of non-passive systems, offer a useful synthesis tool for the design of passivity-based robust controllers for non-passive systems as well. Two synthesis approaches are given for minimizing an LQ-type performance index, resulting in optimal controller gains. Two separate algorithms, one for each of these approaches, are given. The synthesis techniques are demonstraied using two numerical examples: control of a flexible structure and longitudinal control of a fighter aircraft.

Author

Optimal Control; Feedback Control; Aircraft Control; Controllers; Longitudinal Control

19990066676 Joint Test Force, Kirtland AFB, NM USA

JADS/Joint Stars End-to-End Test is an Outstanding Success

Apr. 06, 1999; 3p; In English

Report No.(s): AD-A364809; No Copyright; Avail: CASI; A01, Microfiche; A01, Hardcopy

KIRKLAND AIR FORCE BASE, NM - The Joint Advanced Distributed Simulation (JADS) Joint Test Force (JTF) announced that the live test missions flown on 25 and 31 March 1999 achieved outstanding success and completed the fourth and final phase of the JADS End-to-End (ETE) Test. The ETE Test was designed to evaluate the utility of advanced distributed simulation (ADS), including distributed interactive simulation (DIS), for both developmental and operational test and evaluation of command, control, communications, computers and intelligence (C4I) systems. The ETE Test consisted of four phases: (1) development of the synthetic environment, (2) developmental and operational testing in the laboratory, (3) transition to the prime mission equipment(aircraft, and (4) two live test missions using ADS to populate the battle space with thousands of threat vehicles and then link friendly C4I/weapon system co-actors. The C4I system used in the ETE Test was a Northrop Grumman E-8C Joint Surveillance Target Attack Radar System (Joint STARS). The E-8C aircraft, flown by the Joint STARS Joint Test Force based in Melbourne, Florida, was equipped with an onboard radar processing simulation and integrator called the Virtual Surveillance Target Attack Radar System (VS TARS) that was designed and built by the prime contractor, Northrop Grumman, together with Lockheed Martin and Motorola under a JADS contract During the live test mission, VSTARS, while running concurrently with the E-8C's radar, accepted virtual target information from a Janus war game scenario generator remotely located at the White Sands Missile Range, New Mexico Information was sent over a standardized DIS network and radio frequency linked to the aircraft via a satellite communications (SATCOM) link. VSTARS then converted the data elements into virtual radar reports and seamlessly combined them with live target information the E-8C's radar was collecting from a 1st Cavalry Divis

DTIC

Aircraft Equipment; Electronic Aircraft; Distributed Interactive Simulation; Command and Control; Communication Networks; End-to-End Data Systems

16
PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics. (General)

19990063914 NASA Glenn Research Center, Cleveland, OH USA

Comparison of Interpolation Methods as Applied to Time Synchronous Averaging

Decker, Harry J., Army Research Lab., USA; Zakrajsek, James J., NASA Glenn Research Center, USA; Jun. 1999; 12p; In English; 53rd, 19-22 Apr. 1999, Virginia Beach, VA, USA; Sponsored by Society for Machine Failure Prevention Technology

Contract(s)/Grant(s): DA Proj. 1L1-61102-AH-45; RTOP 581-30-13

Report No.(s): AD-A365208; ARL-TR-1960; NASA-TM-1999-209086; NAS 1.15:209086; E-11669; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Several interpolation techniques were investigated to determine their effect on time synchronous averaging of gear vibration signals and also the effects on standard health monitoring diagnostic parameters. The data was also digitally resampled to determine the effect of lower acquisition rates. The analysis used previously recorded vibration data taken during Health and Usage Monitoring gear testing at the NASA Glenn Research Center. The gear testing monitored the development of surface pitting fatigue on aerospace quality spur gears. Linear, cubic and spline interpolation methods were investigated. Comparisons between the resultant averages show that while there are differences in the resultant time synchronous averages, the differences are not obvious. The diagnostic parameters tested were FM4 and NA4. There are significant differences in the percent deviation curves which imply that the magnitudes of the errors increase as the sample rate decreases.

DTIC

Signal Processing; Vibration; Aircraft Maintenance; Gears; Fatigue (Materials)

19990064104 Massachusetts Inst. of Tech., Gas Turbine Lab., Cambridge, MA USA

Wake Management Strategies for Reduction of Turbomachinery Fan Noise

Waitz, Ian A., Massachusetts Inst. of Tech., USA; [1998]; 7p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The primary objective of our work was to evaluate and test several wake management schemes for the reduction of turbomachinery fan noise. Throughout the course of this work we relied on several tools. These include 1) Two-dimensional steady boundary-layer and wake analyses using MISES (a thin-shear layer Navier-Stokes code), 2) Two-dimensional unsteady wake-stator interaction simulations using UNSFLO, 3) Three-dimensional, steady Navier-Stokes rotor simulations using NEWT, 4) Internal blade passage design using quasi-one-dimensional passage flow models developed at MIT, 5) Acoustic modeling using LINSUB, 6) Acoustic modeling using VO72, 7) Experiments in a low-speed cascade wind-tunnel, and 8) ADP fan rig tests in the MIT Blowdown Compressor.

Author

Wakes; Noise Reduction; Turbomachinery; Boundary Layers; Rotors; One Dimensional Flow; Noise (Sound)

19990069950 NASA Langley Research Center, Hampton, VA USA

XV-15 Tiltrotor Low Noise Approach Operations

Conner, David, Army Aviation and Missile Command, USA; Marcolini, Michael A., NASA Langley Research Center, USA; Decker, William A., NASA Ames Research Center, USA; Cline, John H., Army Research Lab., USA; Edwards, Bryan D., Bell Helicopter Co., USA; Nicks, Colby O., Bell Helicopter Co., USA; Klein, Peter D., Bell Helicopter Co., USA; 1999; In English; 55th, 25-27 May 1999, Montreal, Quebec, Canada; Sponsored by American Helicopter Society, Inc., USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Acoustic data have been acquired for the XV- 15 tiltrotor aircraft performing approach operations for a variety of different approach profile configurations. This flight test program was conducted jointly by NASA, the U.S. Army, and Bell Helicopter Textron, Inc. (BHTI) in June 1997. The XV-15 was flown over a large area microphone array, which was deployed to directly measure the noise footprint produced during actual approach operations. The XV- 15 flew realistic approach profiles that culminated in IGE hover over a landing pad. Aircraft tracking and pilot guidance was provided by a Differential Global Positioning System (DGPS) and a flight director system developed at BHTI. Approach profile designs emphasized noise reduction while maintaining handling qualities sufficient for tiltrotor commercial passenger ride comfort and flight safety under Instrument Flight Rules (IFR) conditions. A discussion of the approach profile design philosophy is provided. Five different approach profiles are discussed in detail -- 3deg., 6 deg., and 9 deg. approaches, and two very different 3 deg. to 9 deg. segmented approaches. The approach profile characteristics are discussed in details, followed by the noise footprints and handling qualities.

Sound exposure levels are also presented on an averaged basis and as a function of the sideline distance for a number of up-range distances from the landing point. A comparison of the noise contour areas is also provided. The results document the variation in tiltrotor noise due to changes in operating condition, and indicate the potential for significant noise reduction using the unique tiltrotor capability of nacelle tilt.

Author

Acoustic Properties; Data Acquisition; Aircraft Detection; XV-15 Aircraft; Controllability; Exposure; Flight Tests; Instrument Flight Rules; Low Noise; Noise Reduction

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SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law, political science, and space policy; and urban technology and transportation.

19990068420 Royal Aeronautical Society, London, UK

Franchising, Code Sharing and Related Matters: Proceedings

Franchising, Code Sharing and Related Matters: Proceedings; 1998; 46p; In English; Franchising, Code Sharing and Related Matters, 11 Feb. 1998, London, UK; See also 19990068421 through 19990068426; ISBN 1-85768-009-X; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This conference discusses the franchising and code sharing in the airline business. It brought together speakers representing various segments of the airline business: small airlines, major airlines and the government regulators.

CASI

Airline Operations; Conferences; Commercialization; Air Transportation; Regulations

19990068421 Gill Airways, Newcastle-upon-Tyne, UK

Partnerships: Our Path to Success

Hart, Malcolm, Gill Airways, UK; Franchising, Code Sharing and Related Matters: Proceedings; 1998, pp. 1.1 - 1.4; In English; See also 19990068420; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

This paper sets out how Gill Airways - a medium-sized airline based at Newcastle - has evolved a WIN/WIN philosophy of partnerships with other airlines. The paper explains how such partnerships have earned Gill access to European markets which, notwithstanding deregulation, would not be open to it otherwise because of prohibitive sales and other costs in non-UK markets. The paper covers the range of partnership activities, from route franchises, to code-sharing, to wet leasing and sub-franchising. It also explains the important partnership between Gill Airways and the Royal Mail, which plays a crucial role in enabling Gill Airways to achieve the cost base that makes airline partnership an effective strategy.

Author

Airline Operations; Civil Aviation; Routes; Air Transportation; Operating Costs

19990068422 British Airways, Competition and Industry Affairs, Heathrow, UK

The Role of Code-Sharing and Franchising in British Airways' Development

Allen, Christopher M., British Airways, UK; Franchising, Code Sharing and Related Matters: Proceedings; 1998, pp. 3.1-3.6; In English; See also 19990068420; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

For most of its life air transport has been a highly regulated industry with little in the way of competition. The travelling public had learned not to expect to be able to make choices and generally accepted, rather uncritically, whatever it happened to be offered to meet its requirements. More recently competition has been permitted, encouraged even. This has meant that consumers have been faced with choices. But it is not always easy for them to make a real choice. Not only is air-transport something which the average consumer does not buy often enough for there to be any prospect of the choice's being based on reasonable experience, but in many cases the choice can be between airlines the customer has never even heard of. Corporations and individual travellers choose to deal with a single, preferred supplier where that is possible. In particular they like to be able to complete any single journey with one airline if they can. This means that for frequent business travellers, whose journeys cover a wide range of destinations, there is attraction in an airline which can meet all their disparate requirements. Equally, for the very many passengers whose journeys may be less frequent but which necessarily involve more than one leg, there is attraction in an airline which can

serve the full journey. Franchising and code-sharing play significant roles in the development of British Airways' global network and are expected to continue to do so.

Derived from text

Airline Operations; Commerce; Passengers; Selection; UK; Costs; Air Transportation

19990068424 BDO Franchising and Brand Development, London, UK

Franchising: Realising the Opportunity

Logan, J., BDO Franchising and Brand Development, UK; McHardy, M., BDO Franchising and Brand Development, UK; Franchising, Code Sharing and Related Matters: Proceedings; 1998, pp. 6.1-6.6; In English; See also 19990068420; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

The franchise model is one of the most powerful business tools available to any organization eager to succeed in a highly competitive environment. Franchising is, however, an undeniably emotive topic. Because it has become a familiar and much used word in a seemingly ever increasing range of business situations, preconceptions abound as to what franchising actually means in practice. As a consequence, it is too often dismissed as a business tool where in truth it could provide real commercial benefits - or, alternatively, embraced in a format that is at best suboptimal and, at worst, damaging for the organisation and/or its partner. Contrary to popular belief, there is no one blue-print or formula for franchising. In a successful business to business franchise, both players have a clearly defined and mutually understood commercial purpose for joining forces one founded on the mutual strengths and motivations of both parties and supported by a clear, open understanding of their respective roles and responsibilities throughout the commercial relationship. Neither is the franchise tool confined to brand growth strategies. The key to unlocking the power which franchising offers right across the air transport and, indeed, travel industry lies in understanding its potential and being innovative in how and where it is applied to generate leading edge business solutions. Despite the opportunities created by airline franchise activity, there is a growing recognition that the opportunity for refining and further applying the franchise model in the air transport industry is vast.

Author

Air Transportation; Airline Operations; Commerce; Costs; Economic Analysis; Efficiency

19990068426 Kreis, Kubac, Svoboda and Kirchweger, Brussels, Belgium

Franchising and Code Sharing Under EU Competition Rules

Kreis, Helmut W. R., Kreis, Kubac, Svoboda and Kirchweger, Belgium; Franchising, Code Sharing and Related Matters: Proceedings; 1998, pp. 8.1-8.5; In English; See also 19990068420; Copyright; Avail: Issuing Activity (The Royal Aeronautical Society, 4 Hamilton Place, London, W1V 0BQ, UK), Hardcopy, Microfiche

FRANCHISING and Code Sharing are well known features for the air transport industry. They represent, however, relatively new phenomena for the European Union's competition law enforcement. With regard to franchising the European Commission adopted in 1986 and 1987 three decisions under Article 85(3) of the Treaty exempting franchise agreements in the cases Yves Rocher and Pronuptia and in the Computerland case from the prohibition of cartels. After having thereby completed its experience in dealing with franchising contracts the European Commission enacted in 1988 a so-called Block Exemption Regulation on the application of Article 85(3) of the Treaty to categories of franchise agreements. Although this Regulation is not part of the package of competition law regulations in transport its applicability to franchise agreements in air transport is not excluded. It also indicates under which circumstances the Commission may intervene against franchise networks in air transport or under which conditions it may grant them individual exemptions. Code Sharing is part of many cooperations between airlines. It helps to build up networks and does not constitute itself a major infringement of EU competition rules. However, code sharing may become a competition law problem where it is combined with other arrangements in cooperation agreements between airlines. A recent and prominent example in this respect are international alliances against which the European Commission has either adopted decisions and imposed conditions like in case Lufthansa/SAS or against which proceedings under Articles 88 and 89 of the Treaty have been initiated like in cases British Airways/American Airlines, the North Atlantic Excellence and the STAR Alliance.

Author

Air Transportation; Airline Operations; Competition; Operating Costs; International Law; Civil Aviation

18
SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.

19990063983 North Carolina State Univ., Mars Mission Research Center, Raleigh, NC USA

An Investigation of Terminal Guidance and Control Techniques for a Robotic Mars Lander *Progress Report, 15 Apr. 1998 - 15 May 1999*

Burge, Brian K., North Carolina State Univ., USA; Walberg, Gerald, North Carolina State Univ., USA; May 13, 1999; 10p; In English

Contracts(s)/Grants(s): NAG1-2086; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Two separate Mars lander touchdown scenarios are considered and compared o a baseline study with the goal of minimizing the landed distance to a specified location on the Mars surface. This study considers a set of points from parachute handoff to touchdown on the surface. The first scenario examines the effect of thrust vectoring while the parachute is deployed and includes an algorithm for determining targeting initial guesses. The second considers a reverse gravity turn to a hover condition 500 meters above!meters!l e surface and then uses lateral thrusting to minimize the range to target. The effects of both scenarios on fuel usage targeting and targeting success are discussed.

Author

Mars Surface; Parachutes; Terminal Guidance; Thrust Vector Control; Touchdown; Automatic Control; Spacecraft Control; Descent Trajectories; Mars Landing; Mars Missions

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GENERAL

19990062580 NASA Ames Research Center, Moffett Field, CA USA

Flight Research at Ames: Fifty-Seven Years of Development and Validation of Aeronautical Technology

Borchers, Paul F., NASA Ames Research Center, USA; Franklin, James A., NASA Ames Research Center, USA; Fletcher, Jay W., NASA Ames Research Center, USA; 1998; 122p; In English

Report No.(s): NASA/SP-1998-3300; NAS 1.21:3300; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This NASA special publication presents a general overview of the flight research that has been conducted at Ames Research Center over the last 57 years. Icing research, transonic model testing, aerodynamics, variable stability aircraft, boundary layer control, short takeoff and landing (STOL), vertical/ short takeoff and landing (V/STOL) and rotorcraft research are among the major topics of interest discussed. Flying qualities, stability and control, performance evaluations, gunsight tracking and guidance and control displays research are also presented. An epilogue is included which presents the significant contributions that came about as a result of research and development conducted at Ames.

CASI

NASA Programs; Histories; Aerodynamics; General Overviews

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